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ABSTRACT

The project reviewed, tested, and analyzed the National Occupational Competency Testing Institute's (NOCTI) test series (written and performance for skilled occupations), using a sample of 16 examinations, to determine their appropriateness for use by the State of Georgia in their selection and certification of vocational and technical educators. To accomplish this, the following objectives were achieved: (1) Review of content validity and overall scope of each of the selected NOCTI tests by trade experts (including secondary and postsecondary teachers) identified based on 16 selected occupational areas; (2) establish a test center and train test center workers to administer NOCTI examinations; (3) select and test a random sample of Georgia vocational-technical teachers to compare scores (written and performance) with measured national norms; determine a cutoff score methodology, compare test results according to race, years of experience, and other appropriate measures; (4) determine the reading level for each of the NOCTI examinations; and (5) survey trade and technical teachers in Georgia, regarding the relationship of NOCTI test topics compared to the curriculum emphasis in current programs. This report includes a discussion of the 14 analyses involved in the content validation and pilot testing of the NOCTI examinations, findings of the analyses, and implications. The appendixes, constituting half the report, include 11 items used in the project (information on the examinations, survey forms, survey results, etc.). (SH)

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VOCATIONAL COMPETENCY TESTING PROJECT

(July 1, 1975 - October 31, 1976)

FINAL REPORT

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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October 31, 1976

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The Vocational Competency Testing Project, undertaken in cooperation with the State Department of Education, Atlanta, Georgia, was made possible by the concerted efforts of many dedicated professionals which we are pleased to recognize.

We would, first of all, like to acknowledge the contribution of several hundred industrial and technical teachers, on both secondary and postsecondary levels, in Georgia, who responded to questionnaires and gave of their personal time to participate in the pilot testing phase of this project.

In addition, NOCTI wishes to express appreciation to the administrators of the Atlanta Area Vocational Technical School, who permitted the use of their facilities for the conduct of examinations. In particular, Mr. Walter Pierce and the staff of examiners are to be congratulated for their spirit and attention to detail, in the conduct of the pilot testing program.

Special recognition is extended to the 79 members of the various trade committees who shared their knowledge, experience, and judgement, in order to determine the content validity of the various NOCTI occupational examinations.

Several other key individuals also played major roles in the success of this program. Dr. Elic Cundiff, Professor of Vocational and Technical Education at the University of Georgia, and Dr. Bettye Hirst, formerly of State Education Department, Georgia; both provided meaningful help along with excellent support during the operational phases of the project. Dr. Gene Bottoms, Director of the Division of Program and Staff Development, Dr. Lester Solomon, Coordinator of Development, and Dr. Paul Scott, former Director of the Occupational Research Coordinating Unit, Georgia State Education Department, provided linkages, insights, and assistance in making this project feasible. Our appreciation is also extended to Mr. Robert Pfeiffer, Manager, Academic Services Programming at the State University of New York at Albany, for his invaluable statistical and computer assistance.

Finally, we wish to acknowledge a future generation of practitioners, who are to benefit as a result of this project. This benefit will be derived as a result of implementation of a valid and reliable personnel selection process, based on an individual's achievement and demonstrated occupational competency.

Leon S. Tunkel

Raymond S. Klein

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SECTION 1

Introduction

Purpose

Objectives

Strategy Employed

INTRODUCTION

The importance of having expert vocational educators, competent in their respective occupations, and professionally trained to teach, is based on the generally held practice that competency, based on both appropriate work and teaching experience, are essential to having quality vocational programs. This study, which was conducted by NOCTI, tested a random sample of Georgia teachers in sixteen (16) occupational areas, and compared test results to national norms as well as new measures of essentiality. The study revealed that the current industrial and technical teachers in Georgia compared favorably with their counterparts in the country as a whole, in terms of work competencies.

To further substantiate the content validity of these examinations, experts were assembled to review the appropriateness of the scope of the examinations, and the items included in each examination. The analysis of the opinions of these experts revealed that the scope and items contained within the NOCTI examinations were valid, with very few exceptions. Measures of high reliability and low standard errors were also revealed for the NOCTI written tests.

In addition to the analyses by committees of experts, a 10 percent random sample of test items within each of the 24 examinations, was subjected to a computer analysis for the purpose of determining the reading grade equivalent for each of the tests. Again, the levels were found to be appropriate for the populations being tested in reasonable relation to the educational requirements for certification in those occupations. It was particularly interesting that the Mechanical Technology test appears to be written in such a fashion that the grade of reading was lower than what might be expected. On the other hand, Civil Technology and Electronics Communications show a reading level above the 12th year (12.2 and 12.9 respectively) which can be considered as appropriate for their intent.

A survey of all secondary and postsecondary teachers in Georgia revealed that weight given to curricular areas covered by the NOCTI tests, generally agrees with time spent in these areas in a learning setting. Sufficient agreement was found to demonstrate that for many of the subjects taught, significant relationships exist.

A brief summary of the specific analyses employed in this study follows.

VOCATIONAL COMPETENCY TESTING PROJECT
FOR THE STATE OF GEORGIA

Purpose

This report has been prepared in accordance with the contract between the State Department of Georgia and NOCTI covering the period of time of July 1, 1975 to September 30, 1976.

The purpose of the contract was to demonstrate the feasibility of developing and administering a vocational competency testing program for new vocational teachers (secondary & postsecondary). Major areas in the project include:

1. The development of occupational competency testing procedures in compliance with Federal Regulations concerned with Chapter 29 of the labor laws, promulgated by the Equal Employment Opportunity Commission and published in the Federal Register, Volume 35, Number 149, August 1, 1970.
2. The undertaking of the planning for the development and operation of appropriate test centers in the State of Georgia.
3. The training of test center operational personnel, in relation to the conduct of NOCTI examinations.
4. The undertaking of a content validation study, to determine appropriateness of selected (NOCTI) exams.
5. The testing of a random sample of vocational-technical teachers in selected occupations, to determine fairness of tests.
6. A study of specified aspects of NOCTI examination procedures related to the establishment of a vocational-technical teacher selection and certification procedure for the State of Georgia.
7. Preparation of appropriate reports and documentation.

Objectives

The objectives of this project were to review, test, and analyze the NOCTI test series (written and performance for skilled occupations), to determine their appropriateness, for use by the State of Georgia in their selection and certification of vocational and technical educators.

In order to accomplish this, the following operational objectives were achieved.

1. Determination by the State Education Department of those occupational areas to be used as a sample for this study, (N=16).
2. Based on the 16 occupational areas selected, Trade experts were identified, including teachers both from a postsecondary and secondary level, to meet to review and comment upon the content validity of the overall scope, weight given to sub-headings, and items included in each test.
3. The establishment of a test center for the purpose of pilot testing NOCTI examinations.
4. The training of test center workers for the purpose of administering NOCTI examinations.
5. A listing of all secondary and postsecondary vocational-technical education instructors in the State of Georgia, for the purpose of selecting a sample grouped by occupation, level (secondary, postsecondary), by years of experience, and by race. In addition, a control was identified reflective of candidates who usually take NOCTI examinations. (Candidates referred by University of Georgia, Athens)
6. Testing of a random sample of Georgia vocational-technical teachers for the purposes of comparing scores, (written and performance) with measured national norms, determining a cut off score methodology, comparison of test results based on race, years of experience, and other appropriate measures.
7. Determining the reading level for each of the NOCTI examinations.
8. Survey of trade and technical teachers in Georgia, regarding the relationship of NOCTI test topics compared to the curriculum emphasis in current programs.
9. A review of Federal EEOC guidelines and U. S. Civil Service Regulations, as they pertain to personnel selection.

Strategy Employed

The Federal EEOC Guidelines state that "It is ... recognized that professional developed tests when used in conjunction with other tools of personnel assessment and complemented by sound programs of job design, may significantly aid in the development and maintenance of an efficient work force. And, indeed, aid in the utilization and conservation of human resources generally." This research study has been undertaken in compliance with EEOC requirements, as well as the Professional Standards for Educational and Psychological Tests, published by the American Psychological Association in 1974.

The State Education Department of the State of Georgia, in line with its mission and responsibility to provide quality vocational and technical education for the citizens of Georgia, undertook a special study aimed at developing a comprehensive system for assessing the journeymen skill levels of prospective vocational and technical educators. To accomplish this it was reasoned that the use of standardized tests would be a more efficient and effective way of assessing these traits. After a review of the literature and discussions with knowledgeable individuals, the NATIONAL OCCUPATIONAL COMPETENCY TESTING INSTITUTE, NOCTI, was requested to develop and submit a proposal aimed at developing a system for one phase of a screening process which would be used in the selection and certification of vocational and technical educators.

Although the standardized inventories which had been developed by NOCTI, through a federal grant, had involved a careful job analysis, question formulation by experts, testing to determine item difficulty and discriminatory measures, along with measures of the reliability; it was felt that in order to be in compliance with the federal regulations, a local demonstration of the validity of these instruments had to be undertaken. This was accomplished through the use of various trade committees.

Because the NOCTI examinations are based on information obtained through careful job analysis, it was felt that a content review of each examination by experts would suffice to demonstrate validity. Occupational and teacher committees in Georgia were assembled to undertake this evaluation. A sample of (16) NOCTI examinations were selected to be studied. Items contained in the examinations were judged and tested in terms of their intended application in Georgia. The federal guidelines stipulate that the relationship between the test and at least one reliable criterion must be statistically significant at the .05 level. This criterion applied to the responses given by trade committee members was applied. Responses of each of the members of these committees were compared to a set of minimum acceptable standards, and to test for appropriateness. This was done to demonstrate that the items contained suitable examples of related skills and behaviors composing the jobs in such question. Furthermore, it was important to verify the knowledge and behaviors asked for in the exams were of such a nature that they represented learnings which could only have been acquired over some extended period of time, such as in the case of an apprenticeship program leading to journeymen stature in a skilled trade.

In order to demonstrate the validity of the exam, it was recognized that the examinations must be given to an appropriate sample of successful practitioners of the job or jobs in question. The sample was drawn in consideration of several variables in the population to be tested. These included drawing random samples from a population of all secondary and postsecondary vocational and technical teachers in Georgia, based on occupation, years of experience, level (secondary, postsecondary), and race. The sample contained present employees, and as a control, individuals who normally take the competency test in Georgia were also included. These were candidates who had applied to take these tests during the same time period the pilot testing was conducted.

From a population of approximately 700 vocational secondary and postsecondary teachers, a random sample was drawn. This sample was based on level of teaching, occupation taught, years of experience, and race. All of the population was randomized and dichotomized. The first group consisted of the sample to be tested, the second represented candidates who could be substituted if required. To ensure that there would be an adequate number of black candidates in the sample, it was decided to invite all of the black vocational and technical teachers in Georgia to participate. In addition, for a control, all individuals who requested to be tested through the NOCTI center at the University of Georgia, at Athens, were allowed to take the test gratis. Arrangements for these tests were made to hold the test at Atlanta Area Vocational and Technical School. The tests were conducted over four weekends. They were held on May 13, 14, 21, 22; July 16, 17, 23, 24, of 1976. A total of 238 candidates were tested during this period.

Scores were compared to national norms; comparisons were made between scores of white candidates and black candidates. Reliability measures were also obtained. In addition, a 10 percent random sample of items contained on each NOCTI test was drawn and subjected to a computer analysis to determine the grade reading level of each exam.

A survey also had been mailed to the same population of vocational educators. This was done to determine what relationships existed, if any, between current proportion of weight given to topics on the NOCTI tests and the percent of time given to these same topics in the curriculum.

Content reviews were made of the EEOC regulations of August 1970, along with new civil service regulations which were issued in July 1976. This was done to help assure compliance. The data from all of these sources was collected and analyzed. Assistance in data processing was provided by the Computer Center of the State University of New York at Albany.

SECTION 2
CONTENT VALIDATION

Background

Methodology

Section 2

Content Validation of 16 Selected NOCTI Examinations

This section is primarily concerned with presentation of the data outcomes obtained through evaluative reviews of 16 NOCTI examinations, both written and performance, by trade committees in Georgia representing the respective occupations. These committee reviews are part of a sequence of approaches which are aimed at providing for a content validation of NOCTI examinations specifically applicable to the purpose of the project. Details regarding formulation and actions of the committees are in the methodology portion of this section.

In developing the approaches for content validation, of which this section is just one part, the standards of the American Psychological Association have been considered along with other applicable standards including sound statistical treatment and test construction theory. In addition, special attention has been given to pertinent federal regulations, in particular those promulgated by the Equal Employment Opportunity Commission and the standards of appropriateness and validity reflected in recent court actions in interpretation of these regulations.

Background

The family of 24 NOCTI examinations, each consisting of a separate written test and a separate performance test, were developed and evaluated during a three-year period, from 1970 to 1973. A survey of the field was conducted, job analyses were performed, and test items formulated and reviewed by experts in the respective fields. The instruments were applied to sample populations and item analyses were performed on the written tests. When the appropriate adjustments were made, the instruments were used and measures of reliability were obtained. Kuder Richardson (20 and 21) correlations were found to range from .75 to .95, with the mode at approximately .90.

Although these tests were carefully constructed and tested, and national norms established, it was deemed appropriate to establish a procedure to ascertain their appropriateness for application to a selection process to be used by the State of Georgia in their certification of Vocational teachers in trade, industrial, and technical fields, and at both secondary and post-secondary levels. The specific procedures for establishing appropriateness of the NOCTI test follows.

Methodology

Trade committees for 16 occupations, representing secondary and post-secondary occupational education, were selected by representatives of the State Department of Education, Georgia (See Appendix A & B). The committees were then scheduled to convene, during January 1976, to evaluate 16 selected NOCTI examinations, each consisting of a comprehensive written test and a representative performance test, in respect to:

1. Adequacy of test coverage of related information, trade skills and knowledge, and other trade practices pertinent to each occupational field.
2. The extent to which the Scope of Examination and the relative weight allocated to each subheading were consistent with the informational and manipulative competence expected of an occupational teacher in Georgia.
3. Appropriateness of each item in the written tests, as prerequisite knowledge for an occupational teacher.

A separate instrument was developed for each of the three evaluative approaches and the instruments were field tested with two committees, namely, Air Conditioning and Refrigeration, and Cosmetology. Slight mechanical modification of the instruments was indicated by the field test to make them more self-explanatory and understandable. Content of the instruments remained the same. Samples of the three instruments are in the Appendix. The instruments identified as Appendix "C" and "E" were uniformly presented to all committees. The instrument, identified as Appendix "D" is a sample, specific to the occupation. Instruments for each of the 16 occupations in the study were separately presented to each committee, with the specific subheadings and weightings identified in the NOCTI Bulletin of Information for Candidates for each occupation. Each committee participant was provided with a copy of the Bulletin, which contains detailed descriptions of the subject content under each subheading of each occupation.

The trade committees were convened in clusters of 4 or 5 groups. Under the supervisory guidance of a NOCTI representative, all committee participants make independent evaluations of the respective NOCTI examination, on each of the 3 evaluative instruments. Specific aspects of the evaluative review are identified in the body of this section.

ANALYSIS #1-Overall Evaluation

Purpose

To determine adequacy regarding selected NOCTI examinations (in 16 occupations) in Georgia in terms of the following criteria:

Criteria

WRITTEN TEST:

1. The Scope covers the technical and trade knowledge and practices expected of a vocational teacher in Georgia.
2. The Scope covers the related information (science and mathematics) a competent vocational teacher uses in his work.
3. The Scope covers the auxiliary-personal occupational skills a competent vocational teacher applies to his work.

PERFORMANCE TEST:

1. The tasks selected are typical of those performed by competent vocational teachers in Georgia.
2. The descriptions of skills, methods, and procedures required for the tasks are representative of those used by competent vocational teachers in Georgia.
3. The tasks require understanding of blueprints, specifications, or other forms of directions and standards required of competent vocational teachers in Georgia.
4. The range of trade information and skills is representative of those expected of a competent vocational teacher in Georgia.

Analytical Review

The nature of the rating scale of this instrument (Appendix "C") permitted the use of a "t" test to measure adequacy of the average responses from a standard.

The above criteria were applied by competent judges who reviewed the 16 examinations. Ratings were obtained as to degree to which these criteria were met by the 16 NOCTI examinations. A five point rating scale was used where 3 represented a minimum standard for adequacy.

The following hypothesis was tested:

The overall Scopes of the examinations are appropriate and adequate in terms of the stated criteria.

Discussion

Data were obtained from 79 trade experts to determine the overall appropriateness and adequacy of selected NOCTI examinations, (N=16). Using the range in place of the Standard Deviation in the "t" test to determine the adequacy of the NOCTI instruments, all ratings below a standard measure were tested to see if the differences were significant. The purpose of this test is to determine whether or not these instruments were appropriate and adequate in terms of the job they were designed to accomplish for the State of Georgia. The findings are summarized in Table 1 and indicate that the Georgia vocational education experts agree in terms of appropriateness and overall adequacy of scope of these examinations. It was learned that only two (2) criteria out of 112 tested reached significance at .01. Because the samples were small, a CV.01 was selected to reduce the effects of rejecting a true hypothesis due to random fluctuations. Therefore, these two areas were judged to be not adequate for the purposes for which they were designed.

These were:

1. Diesel Engine Repair

One criterion out of seven was found to reveal a significant difference. This difference appeared with the third criterion for written test, dealing with auxilliary-personal occupational skills. The judges felt this area is not adequately covered in the examination.

2. Architectural Drafting

This test revealed that the standard of adequacy for the related information criterion on the written test was not reached.

Thus, the results of this review and test of adequacy indicate that only two criteria of the 112 tested, covering 16 written and 16 performance examinations, failed to meet the standards.

Details of these findings are provided in a summary table (see Table 1), and a copy of the evaluative instrument is included as Appendix "C".

Table 1 - NOCTI Examinations - Content Validation - Georgia

Summary of Adequacy Measures - "t" Test

Examinations	Criteria for Written Examination				Criteria for Performance Examination				
	1	2	3	CV.01	1	2	3	4	CV.01
Air Conditioning	-3.07	-6.72	-0.88	0.429	-2.05	-3.07	-3.21	-3.21	0.429
Architectural Drafting	-0.66	0.83*	0.00	0.523	-0.17	-0.16	0.00	-0.66	0.523
Auto Body Repair	-0.40	0.00	0.20	0.685	-0.20	0.00	0.00	-0.20	0.685
Auto Mechanic	-0.08	0.25	-0.17	0.523	-0.20	-0.10	0.20	-0.20	0.523
Carpentry	-0.40	0.00	-0.60	0.685	0.00	-0.40	0.00	-0.20	0.685
Cosmetology	0.04	0.09	0.19	0.523	-0.03	0.09	0.10	0.06	0.523
Diesel Engine Repair	-0.20	0.20	1.20*	0.685	0.13	-0.20	0.00	-0.20	0.685
Electrical Installation	-0.17	-0.08	-0.30	0.523	0.00	0.20	0.00	-0.17	0.523
Electronics Communication	0.00	0.60	0.60	0.685	0.00	0.00	0.00	0.00	0.685
Industrial Electrician	0.00	0.00	0.00	2.111	-0.50	0.00	0.50	0.00	15.910
Industrial Electronics	-0.25	-0.50	-0.50	1.023	0.25	0.00	0.00	-0.25	1.023
Machine Drafting	-0.30	0.30	0.00	2.111	0.30	0.00	-0.15	0.00	2.111
Machine Trades	-0.20	-0.20	0.00	0.685	-0.20	0.00	0.00	-0.20	0.685
Masonry	-0.30	0.17	0.00	0.523	-0.17	0.00	0.33	0.00	0.523
Printing	0.00	0.00	0.50	1.023	0.00	0.00	0.00	0.00	1.023
Welding	0.00	0.30	0.50	0.685	0.07	0.20	0.20	0.07	0.685

NOTES:

- a. Are the averages of the ratings of judges significantly less than the standard for adequacy?
 Values have to be equal or greater than CV to infer inadequacy - This occurs when applying the standards in two cases of the written test. *Architectural Drafting - #2 related information
 *Diesel Engine Repair - #3 auxiliary personal skills

- b. $\bar{X}$ = Means for N observations

Mo = Standard - based on a midpoint of a five place rating scale where:

- | | |
|--------------------------------|-----------------------|
| 5. much more than adequate | 2. not quite adequate |
| 4. more than adequate | 1. inadequate |
| 3. is the standard of adequacy | |

W = difference between largest and smallest of the N observations

- c. Significance at .01 (See "The Use of the Range in Place of the Standard Deviation", Biometrika, Vol. (34) 1947)

$$\alpha = \frac{\bar{X} - Mo}{W}$$

Conclusion

The findings tend to support this hypothesis and, therefore, reflect a measure of content validity insofar as the overall nature of the instruments are concerned.

Where differences were uncovered, some form of change may be indicated. For example, one or more of the following options may be pursued:

Options-

1. Limit tests only to areas of agreement.
2. Continue to check by examining micro measures (items) and test to see if appropriateness and adequacy can be substantiated. (A test of the adequacy and appropriateness of individual items on each examination is discussed in a subsequent section of this report).
3. Improve the content in those two areas which have failed to meet the minimum standard.

ANALYSIS #2-Evaluation of Scope of Examination

Purpose

To determine the appropriateness and adequacy of the subheading topics of 32 NOCTI examinations, (written and performance examinations in 16 occupations).

Method

Data was obtained (Sample-Evaluation Form-Appendix D) from 79 Trade experts to determine if the National Standards assigned to sub-headings of various NOCTI examinations applied to Georgia and, where different, to establish whether the differences were significant.

Comparisons were made by use of the Wilcoxon-Mann-Whitney test for independent samples.

This test was selected as being appropriate by virtue of having the following characteristics:

1. A non-parametric, distribution free test suitable where assumptions of normality do not apply.
2. Appropriate for paired comparisons of measures which can be ranked.
3. Uses measures of central tendency where homogeneity of variance is not applicable (compares medians as opposed to means).

The results of the comparison showed no significant differences for each of the 32 examinations. Details of these findings are provided in the Summary Tables 2 & 3.

Conclusion

The sub-topics and their respective weightings, developed nationally for the National Occupational Competency Tests, which were reviewed, were judged to be appropriate and adequate for Georgia at the .01 confidence level.

NOCTI Examinations - Content Validation Study - Georgia

Table 2 Summary of Evaluation - Scope of Written Examinations by Subheading Values
Measured by the Wilcoxon - Mann - Whitney Test

<u>WRITTEN EXAMINATION</u>	<u>(N)</u>	<u>R, CV</u>	<u>R_B</u>	<u>Sig. Dif.</u>	<u>Appropriateness</u>
Air Conditioning & Refrigeration	6	.01 (8,8) = 43 .05 (8,8) = 49	65 66	No No	Yes Yes
Architectural Drafting	6	.01 (5,5) = 15 .05 (5,5) = 17	26.5 26.5	No No	Yes Yes
Auto Body Repair	5	.01 (8,8) = 43 .05 (8,8) = 49	70 70	No No	Yes Yes
Auto Mechanics	6	.01 (10,10) = 71 .05 (10,10) = 78	103 103	No No	Yes Yes
Carpentry	5	.01 (12,12) = 105 .05 (12,12) = 115	149.5 149.5	No No	Yes Yes
Cosmetology	6	.01 (13,13) = 125 .05 (13,13) = 136	168.5 168.5	No No	Yes Yes
Diesel Engine Repair	5	.01 (5,5) = 15 .05 (5,5) = 17	28 28	No No	Yes Yes
Electrical Installation	6	.01 (10,10) = 71 .05 (10,10) = 78	115 115	No No	Yes Yes

NOCTI Examinations - Content Validation Study - Georgia

Table 2 - (continued)

WRITTEN EXAMINATION	(N)	R, CV	R _B	Sig. Dif.	Appropriateness
Electronic Communications	5	.01(12,12) = 105	150	No	Yes
		.05(12,12) = 115	150	No	Yes
Industrial Electrician	3	.01 (5,5) = 15	30.5	No	Yes
		.05(5,5) = 17	30.5	No	Yes
Industrial Electronics	4	.01(12,12) = 105	143	No	Yes
		.05(12,12) = 115	143	No	Yes
Machine Drafting	2	.01 (9,9) = 56	82.5	No	Yes
		.05(9,9) = 62	82.5	No	Yes
Machine Trades	6	.01(12,12) = 105	145	No	Yes
		.05(12,12) = 115	145	No	Yes
Masonry	6	.01 (7,7) = 32	47	No	Yes
		.05(7,7) = 36	47	No	Yes
Printing	4	.01 (6,6) = 23	41	No	Yes
		.05(6,6) = 26	41	No	Yes
Welding	4	.01(10,10) = 71	99	No	Yes
		.05(10,10) = 78	99	No	Yes

NOTES:

N = The number of experts

R, CV = The critical values for comparing small rankings (obtained from Table of Critical Values of Smaller Rank Sum for the Wilcoxon-Mann-Whitney Test, Non-Parametric and Shortcut Statistics, by M. W. Tate and R. C. Clelland, 1957, Interstate Printers and Publishers, Inc.).

R_B = The sum of the ranks for the sample

Significant Difference = R_B has to equal or be less than R, CV.

Appropriateness = In this case since significant differences have not been found, the average weights given by the Georgia experts to subheadings are in line with standards established for the nation. Therefore, the national standards appear to be appropriate.

NOCTI Examinations - Content Validation Study - Georgia

Table 3 Summary of Evaluation - Scope of Performance Examinations by Subheading Values
Measured by the Wilcoxon - Mann - Whitney Test

PERFORMANCE EXAMINATION	(N)	R, CV	R _B	Sig. Div.	Appropriateness
Air Conditioning & Refrigeration	6	.01 (3,3) = NA .05 (3,3) = 6	9	No	Yes
Architectural Drafting	6	.01 (6,6) = 23 .05 (6,6) = 26	30.5 30.5	No No	Yes Yes
Auto Body Repair	5	.01 (4,4) = NA .05 (4,4) = 10	16	No	Yes
Auto Mechanics	6	.01 (12,12) = 105 .05 (12,12) = 115	150.5 150.5	No No	Yes Yes
Carpentry	4	.01 (5,5) = 15 .05 (5,5) = 17	25 25	No No	Yes Yes
Cosmetology	6	.01 (10,10) = 71 .05 (10,10) = 78	99 99	No No	Yes Yes
Diesel Engine Repair	5	.01 (6,6) = 23 .05 (6,6) = 26	38 38	No No	Yes Yes
Electrical Installation	5	.01 (6,6) = 23 .01 (6,6) = 26	39 39	No No	Yes Yes

NOCTI Examinations - Content Validation Study - Georgia

Table 3 -(continued)

PERFORMANCE EXAMINATION	(N)	R, C V	R _B	Sig. Div.	Appropriateness
Electronic Communications	5	.01 (3,3) = NA .05 (3,3) = 6	CA CA	No No	Yes Yes
Industrial Electrician	3	.01 (4,4) = NA .05 (4,4) = 10	17.5	No	Yes
Industrial Electronics	4	.01 (4,4) = NA .05 (4,4) = 10	18.5	No	Yes
Machine Drafting	2	.01 (5,5) = 15 .05 (5,5) = 17	26 26	No No	Yes Yes
Machine Trades	6	.01 (7,7) = 32 .05 (7,7) = 36	54 54	No No	Yes Yes
Masonry	5	.01 (4,4) = NA .05 (4,4) = 10	16.5	No	Yes
Printing	3	.01 (6,6) = 23 .05 (6,6) = 26	37 37	No No	Yes Yes
Welding	4	.01 (3,3) = NA .05 (3,3) = 6	9	No	Yes

NOTES:

N = The number of experts

R, CV = The critical values for comparing small rankings (obtained from Table of Critical Values of Smaller Rank Sum for the Wilcoxon-Mann-Whitney Test, Non-Parametric and Shortcut Statistics, by M. W. Tate and R. C. Clelland, 1957, Interstate Printers and Publishers, Inc.).

R_B = The sum of the ranks for the sample

CA = Complete agreement NA = Sample too small for CV @ .01

Significant Difference = R_B has to equal or be less than R, CV.

Appropriateness = In this case since significant differences have not been found, the average weights given by the Georgia experts to subheadings are in line with standards established for the nation. Therefore, the national standards appear to be appropriate.

ANALYSIS #3-Written Test-Item Evaluation

Purpose

To determine the adequacy of the written test items, of 16 selected NOCTI examinations, in Georgia in terms of the following criteria:

Criteria

The importance of each item as prerequisite knowledge for a vocational teacher, rated on the basis of the scale below. (See Appendix E - Form for Written Test Item Evaluation)

- A. Essential - must know
- B. Should know but not essential
- C. Doesn't matter if the teacher knows or not

Analytical Review

A "t" test was applied to each item of every test rated by expert judges in 16 occupational fields, where:

$$\text{Item Adequacy} = \frac{S - \bar{X}}{W}$$

Notes: S = Standard = (2)
 $\bar{X}$ = Mean of judges responses
W = Difference between largest and smallest observation

This formula of adequacy was applied to each item of every written test using the following scale: Criterion A = 3
" B = 2
" C = 1

Those items which were found to be significantly different at CV.01 are identified in Table 4.

A total examination adequacy measure was then applied to describe the ratio between adequate and inadequate items, as determined by trade committee experts. The test used is described below.

$$\text{Test Adequacy} = 1 - \left(\frac{\sum n}{N} \right)$$

Notes: n = Item at CV.01
N = Total items for each test

Follow-up Study

As identified in the Methodology section of this section, field test of the evaluation instruments was initially made with Trade Committees in Cosmetology, and Air Conditioning and Refrigeration, prior to using the instruments with the remaining 14 Trade Committees. In obtaining the evaluations of these two (2) committees, the individual judges were permitted to interact with each other before arriving at an opinion. The resulting evaluations suggested that future committees be directed to making independent judgements on each of the three (3) evaluative instruments and the remaining 14 committee's evaluations were conducted on this standard.

As one of the alternatives for bringing all test evaluations to the same standard, the judges on the committees for Air Conditioning and Refrigeration and on the committee for Cosmetology were requested, by mail, to evaluate again the individual items on the written tests using the revised evaluation document as had been used by all other committees.

Findings

In analyzing judges responses, it was found that in the 16 written NOCTI examinations, the items were judged to be appropriate and adequate. Selected items in two examinations were found to be below an acceptable standard.

Conclusion

All of the 2449 NOCTI test items with 3 exceptions, meet the standard for all test items for Georgia at the .01 confidence level.

Table 4 provided a summary of the item evaluations made by Trade committee members.

Table 4 NOCTI Examinations-Content Validation-Georgia
Summary of Items for Written Section-"T" Test

<u>Examinations</u>	<u>N</u>	<u>Items CV-.01</u>	<u>Adequacy Measure</u>
1. Air Conditioning & Refrigeration	6	None None	1.000
2. Architectural Drafting	6	None	1.000
3. Auto Body Repair	5	One	.993
4. Auto Mechanic	6	None	1.000
5. Carpentry	5	None	1.000
6. Cosmetology	6	Two	.983
7. Diesel Engine Repair	5	None	1.000
8. Electrical Installation	6	None	1.000
9. Electronics Communication	5	None	1.000
10. Industrial Electrician	3	None	1.000
11. Industrial Electronics	4	None	1.000
12. Machine Drafting	3	None	1.000
13. Machine Trades	5	None	1.000
14. Masonry	6	None	1.000
15. Printing	4	None	1.000
16. Welding	4	None	1.000

NOTES: N = Number of judges

$$\text{Adequacy} = 1 - \frac{(\sum n)}{N}$$

N CV.01

3 - 2.11

4 - 1.023

5 - .685

6 - .523

n = item at CV.01

N = Total test items

Significance at .01 (See "The Use of the Range in Place of the Standard Deviation",
 Biometrika, Volume (34) 1947).

General Conclusion - Content Validation

As a result of these evaluations, the following conclusion had been reached:

All 16 NOCTI examinations (written and performance) appear to be appropriate and adequate, and national standards are applicable with the following concern:

Additional question items should be considered in the areas of related information for the Architectural Drafting Examination, and for auxilliary personal occupational skills in the Diesel Engine Repair test. However, the current items in these tests appear to be adequate as revealed in the item review.

ANALYSIS # 4-Test Reliability

Purpose

Even though measures of reliability based on national data were high, it was deemed appropriate to obtain similar measures using Georgia candidates exclusively.

Test Reliability

Measures of reliability and standard error were obtained for the 16 written tests. These measures indicate that the NOCTI Competency tests have high reliability and small standard errors of the measurement.

Conclusion

Therefore, the instruments are judged to be adequate in terms of their internal consistency.

Table 5 summarizes these findings.

SUMMARY OF MEASURES RELATED TO SELECTED NOCTI WRITTEN TESTS

Test	1	2	3	4	5	6	7	8	9	10	11	12	13	14
ACON	14	165	96	141	46	119.8	14.81	121.0	11.09	.719	.189	.91	.87	4.53
ARCHD	11	150	83	181	36	100.6	8.73	122.5	2.75	.665	.095	.75	.87	4.38
AMECH	18	200	92	163	72	127.4	17.17	130.0	6.00	.632	.165	.90	.95	5.43
AUTOB	7	150	85	116	32	99.6	12.07	100.5	9.00	.659	.233	.86	.80	4.55
CARP	7	159	94	125	32	112.7	12.24	117.5	9.00	.699	.173	.86	.87	4.52
COSMO	12	120	86	105	20	94.7	6.10	94.5	5.0	.786	.110	.72	.84	3.23
DIENG	4	167	95	123	29	112.2	12.20	115.5	8.25	.672	.144	.87	.95	4.48
ELCOM	8	130	76	116	41	100.9	17.25	110.0	15.75	.781	.766	.95	.89	3.72
ESTAL	5	177	60	110	51	90.6	19.02	97.0	15.75	.505	.178	.93	.91	5.04
IELAN	7	200	38	168	131	113.7	52.65	133.5	35.50	.564	.617	.99	1.00	4.76
IERIC	9	150	47	114	68	92.9	23.28	106.0	17.25	.614	.302	.96	.97	4.60
MACHD	7	135	94	127	34	103.7	12.96	98.5	6.50	.759	.207	.91	.89	3.82
MACHT	14	160	72	118	47	93.6	14.64	95.5	10.75	.581	.191	.89	.91	4.95
MASON	10	100	58	89	32	75.4	11.31	77.5	8.75	.748	.259	.91	.94	3.35
PRINT	2	131	66	81	16	73.5	10.61	73.5	3.75	.561	.114	.88	.89	3.60
WELD	8	150	55	98	44	85.5	13.60	91.0	5.75	.568	.144	.88	.95	4.69

KEY: 1 = No. Tested	8 = Median
2 = No. Questions	9 = Semi Inter Quartile Deviation
3 = Low Score	10 = Mean Item Difficulty
4 = High Score	11 = Mean Item Discrimination
5 = Range	12 = KR20
6 = Mean	13 = Split Half
7 = Standard Deviation	14 = Standard Error Measurement

NOTE: These measures were obtained as a result of the Georgia Competency Testing Project.
The measures of reliability are high and the standard errors of measurement are small.

ANALYSIS #5 - Determining Reading Level

Determining the Reading Level of the NOCTI Tests

The general computer program (STAR), developed by General Motors Corporation, was adopted to determine the grade reading level for each of the NOCTI tests. A ten percent random sample of test items from each test was drawn and the items identified were subjected to the STAR analysis procedure.

Findings

The study revealed that the average reading level, for NOCTI tests is equivalent to 9.4 grade level, with a range 12.9 for Electronics Communication, to 6.5 for Masonry.

Conclusion

The reading levels appear to be appropriate for the population being tested. Those occupations which require more theory tend to have higher reading levels with the exception of Mechanical Technology, which appears to be lower than might be expected.

Table 6 provides a summary of grade levels for each of the 24 written tests.

Table 7 provides a summary of selective data used to determine the grade reading level.

These tests were run to verify the generally held opinion that the exams would not cause any undue biases because of level of difficulty of the words and construction included in the exams.

TABLE 6
GRADE LEVEL READABILITY EQUIVALENT FOR WRITTEN TESTS*

Grade Level	Title of Tests	Codes
11.8	Air Conditioning and Refrigeration	06
11.3	Airframe and Powerplant	01
9.3	Architectural Drafting	12
8.2	Auto Body Repair	02
8.6	Auto Mechanic	03
8.1	Cabinet Making and Millwork	24
7.2	Carpentry	07
12.2	Civil Technology	18
8.3	Cosmetology	22
10.8	Diesel Engine Repair	04
10.9	Electrical Installation	08
12.9	Electronics Communications	15
10.6	Industrial Electrician	14
11.4	Industrial Electronics	16
7.1	Machine Drafting	13
7.3	Machine Trades	20
6.5	Masonry	09
8.6	Mechanical Technology	23
8.1	Plumbing	10
10.0	Printing	19
8.5	Quantity Food Preparation	17
8.2	Sheet Metal	11
7.9	Small Engine Repair	05
11.6	Welding	21

* Based on Flesch Index

TABLE 7

NATIONAL OCCUPATIONAL COMPETENCY TESTING INSTITUTE

Analysis of Reading Level of Written Tests
Selected Written Test Measures

	06*	01	12	02	03	24
NUMBER OF SENTENCES =	27.0	27.0	15.0	19.0	29.0	27.0
NUMBER OF WORDS =	399.0	394.0	233.0	253.0	458.0	353.0
NUMBER OF SYLLABLES =	651.0	636.0	352.0	372.0	669.0	517.0
AVERAGE SENTENCE LENGTH =	14.8	14.6	15.5	13.3	15.8	13.1
AVG. SYLLABLES PER WORD =	1.6	1.6	1.5	1.5	1.5	1.5
FLESCH INDEX =	53.8	55.5	63.3	68.9	67.2	69.7
DALE INDEX =	8.7	8.6	8.2	7.9	7.9	7.8
GRADE LEVEL EQUIVALENT =	11.8	11.3	9.3	8.2	8.6	8.1
	07	18	22	04	08	15
NUMBER OF SENTENCES =	26.0	27.0	12.0	23.0	25.0	22.0
NUMBER OF WORDS =	341.0	493.0	180.0	422.0	348.0	295.0
NUMBER OF SYLLABLES =	464.0	792.0	262.0	654.0	559.0	499.0
AVERAGE SENTENCE LENGTH =	13.1	18.3	15.0	18.3	13.9	13.4
AVG. SYLLABLES PER WORD =	1.4	1.6	1.5	1.5	1.6	1.7
FLESCH INDEX =	78.4	52.4	68.5	57.1	56.8	50.1
DALE INDEX =	7.4	8.8	7.9	8.5	8.5	8.9
GRADE LEVEL EQUIVALENT =	7.2	12.2	8.3	10.8	10.9	12.9
	14	16	13	20	09	23
NUMBER OF SENTENCES =	21.0	23.0	26.0	21.0	11.0	10.0
NUMBER OF WORDS =	394.0	378.0	316.0	302.0	146.0	171.0
NUMBER OF SYLLABLES =	606.0	604.0	430.0	413.0	187.0	248.0
AVERAGE SENTENCE LENGTH =	18.8	16.4	12.2	14.4	13.3	17.1
AVG. SYLLABLES PER WORD =	1.5	1.6	1.4	1.4	1.3	1.5
FLESCH INDEX =	57.7	55.0	79.4	76.5	85.0	66.8
DALE INDEX =	8.5	8.6	7.3	7.5	7.0	7.9
GRADE LEVEL EQUIVALENT =	10.6	11.4	7.1	7.3	6.5	8.6
	10	19	17	11	05	21
NUMBER OF SENTENCES =	19.0	17.0	34.0	15.0	23.0	21.0
NUMBER OF WORDS =	283.0	254.0	436.0	184.0	277.0	327.0
NUMBER OF SYLLABLES =	409.0	396.0	650.0	273.0	405.0	528.0
AVERAGE SENTENCE LENGTH =	14.9	14.9	12.8	12.3	12.0	15.6
AVG. SYLLABLES PER WORD =	1.4	1.6	1.5	1.5	1.5	1.6
FLESCH INDEX =	69.5	59.8	67.7	68.9	70.9	54.4
DALE INDEX =	7.8	8.4	7.9	7.9	7.8	8.6
GRADE LEVEL EQUIVALENT =	8.1	10.0	8.5	8.2	7.9	11.6

* Codes for NOCTI Exams

ANALYSIS #6

A COMPARISON OF THE SCOPE OF THE NOCTI WRITTEN AND PERFORMANCE EXAMINATIONS TO CURRENT VOCATIONAL AND TECHNICAL TEACHING PRACTICES IN GEORGIA

Purpose

In compliance with the Federal EEOC regulations on employee selection procedures, an attempt was made to demonstrate the validity of topical areas within the NOCTI test series. This was first accomplished by means of trade committees in 16 occupations reviewing the overall content, specific weights given to subtopics and individual items on each test. This analysis, previously reported in detail in Analyses 1-3, provided evidence that the NOCTI examinations are content valid.

To further demonstrate relationships among the topics covered on the examinations, it was felt that a review by the existing staff of all secondary and postsecondary teachers in the vocational and technical areas would be in order. Because of the security involved with specific test items, only major topical areas on each exam were reviewed, along with the respective weights assigned to these topics on the NOCTI examinations. The existing weights represent the relative importance of these various topics to each trade as determined by job analysis. The review, in turn, was concerned with establishing relationships between weights of topics and the curriculum emphasis given to these topics.

Findings

The survey revealed that positive relationships existed among most of the topics covered on the NOCTI examinations and the emphasis in the curriculum. Looking at the data from the point of view of individual topics, direct correspondence between curriculum emphasis and topics covered on the NOCTI examination exists, but varies depending on occupational areas. The topics on the NOCTI examinations are covered in varying degrees in the curriculum of the secondary and postsecondary vocational schools in Georgia. In examining the relationship of the curriculum, correlations were found to be positive in 13 of the 16 tests studied. Spearman Rank Correlation Coefficients, across all tests to which teachers responded in the survey, were found to be significant at the .001 level, (secondary/NOCTI = $Rho .637$, postsecondary/NOCTI = $Rho .737$). Other significant relationships were also found when examining the relationship on an individual exam basis. These correlations are considered a measure of demonstrated validity of the NOCTI tests.

Approach Used

This section describes the results of a teacher survey conducted in Georgia during the Spring of 1975. The survey was designed to test the relationship between the scope of the curriculum in various trades currently being taught by vocational and technical educators in Georgia, and the weights given to subtopics on the NOCTI tests.

Teachers on both the secondary (N=122) and postsecondary (N=144) levels of specific occupational subjects were asked to review the topics covered within scope of the 16 NOCTI written and performance examinations. By means of a survey, the instructors were requested to review the topics covered by these examinations and indicate the proportion of instructional time currently devoted to each topic.

Table 8 provides measures of overall agreement based on the use of the "t" test. Pearson and Spearman Correlation Coefficients were used to compare the standards percent weights given to the topic in each NOCTI examination with the emphasis given by teachers to the topic in the curriculum. The comparison of each score was then made by using a "t" test.

Table 9 presents the Pearson's Correlation Coefficients describing the relationship for the 16 NOCTI written tests in this study.

Table 10 presents the Spearman Correlation describing the same relationships. (These correlations have been given, for some of the assumptions underlying the use of Pearson Correlation Coefficient may not have been met.)

Conclusion

Although there is direct agreement in selected areas, the results of these analyses indicate that in most cases what is taught in the classroom in terms of the proportion of time given, differs from the weight attention given to these items on 16 NOCTI examinations. However, significant relationships were found which suggests that although direct correspondence does not exist on all levels, that an adequate level of demonstrated validity was uncovered for most of the tests.

TABLE 3

Index of Agreement Based on Specific Topics

NAME OF TEST	LEVEL		
	Secondary	Postsecondary	Combined
Air Conditioning		.50	
Architectural Drafting	.45	.65	.45
Auto Body Repair	.72	.67	.42
Auto Mechanic	.40	.40	
Carpentry	.28	.52	.33
Cosmetology	.35	.17	.17
Diesel Engine Repair		.85	
Electronics Communication	.29		
Electrical Installation	.05	.65	
Industrial Electrician		.15	
Industrial Electronics		.34	
Machine Drafting	.25	.35	.15
Machine Trades	.27	.27	.05
Masonry	.54	.19	
Printing	.77	.50	.50
Welding	.33	.29	.23

NOTE: Index of agreement between time given to units of instruction in vocational education in Georgia and the assigned weighting to major topical categories on selected NOCTI tests. These measures represent the proportion of the NOCTI tests which do not differ significantly with current curriculum emphasis by trade and technical teachers in Georgia.

TABLE 9

NOCTI TEST TOPICS WEIGHTS COMPARED TO CURRICULUM

Pearson's Correlation Coefficients

Test	Sec/Norm	Level	Postsec/Norm	Level	Sec/Post	Level
ACON	-.094		.318		.462	
ARCHD	.645		.864	.05	.914	.05
ABODY	.669	.05	.934	.001	.748	.05
AMECH	.646		.313		.422	
CARP	.649	.05	.705	.01	.861	.001
COSMO	.837	.001	.722	.05	.933	.001
DIENG			.644			
ELCOM	.329		.474		.864	.001
ESTAL	.339		.846	.001	.657	.001
IERAN			-.551			
IERIC			.814	.001		
MACHD	-.342		-.138		.843	.05
MACHT	.633	.05	.795	.001	.903	.001
MASON	.938	.001	.946	.001	.971	.001
PRINT	.120		.489		.718	
WELD	.944	.001	.924	.001	.968	.001

NOTES:

Number of significant correlations

	sig	not sig
secondary	6	7
postsecondary	9	7

The correlation table shows that most of the relationships suggest a substantial agreement between topic importance on the NOCTI tests as ascertained by job analysis, and the current emphasis given to those topics in the trade and technical public school programs in Georgia.

TABLE 10

NOCTI TEST TOPICS WEIGHTS COMPARED TO CURRICULUM

Spearman's Correlation Coefficients

Test	Sec/Norm	Level	Postsec/Norm	Level	Sec/Post	Level
ACON	.098		.244		.571	
ARCHD	.600		.600		1.000	.001
ABODY	.469		.879	.05	.690	
AMECH	.605		.220		.103	
CARP	.774	.05	.704	.01	.785	.001
COSMO	.729	.05	.715	.05	.927	.001
DIENG			.316			
ELCOM	.463		.603	.05	.762	.05
ESTAL	.265		.845	.001	.523	
IERAN			-.730			
IERIC			.783	.001		
MACHD	-.525		-.153		.433	
MACHT	.482		.764	.05	.888	.001
MASON	.558		.435		.306	
PRINT	.353		.464		.638	
WELD	.767	.01	.883	.01	.914	.001
Across all Tests	.637	.001	.735	.001	.827	.001

NOTES:

Number of significant Correlations

	sig	not sig
secondary	3	10
postsecondary	8	8
across all tests	3	-

The significant correlation found across all the total test series suggests that the content covered by the NOCTI tests is also required of current practioners in their roles as teachers of trade and technical subjects in Georgia.

SECTION 3

PILOT TESTING OF NOCTI EXAMINATIONS

Sampling Design

Determining the Independence of the NOCTI Tests

ANOVA by Race

ANOVA by Level

Comparison to National Norms

Other Relationships

Comparison of Written Test Scores

Selected Items Judged Essential

SECTION 3

ANALYSIS #7-- Sampling Design

Purpose

The purpose of this design was to randomize the current population of vocational and technical teachers in Georgia, in order to draw appropriate samples based on selected characteristics.

Approach Used

The populations were classified according to present teaching level, occupational field, experience, and race. At first, it had been decided to conduct the test at two sites in Georgia. However, in order not to have to control for one variable, that is the conduct of the examination at two sites, the feasibility of holding the test at one location was determined and arranged. When there was agreement in regard to this procedure, a computerized random sort was undertaken. Attempts were made to match candidates on the above characteristics. However, because the number of blacks in the population were proportionately small, as compared to whites, it was decided to include all blacks in the sampling design.

In addition to the sample drawn, a randomized sample, which included all of the remaining teachers, was also prepared. This was done in order to facilitate the replacement of test candidates when substitutions were required. Since the NOCTI examinations were being used in Georgia to determine advanced placement credits in selected universities, it was decided to include all of the candidates, who had requested to be tested during the spring testing cycle, in the experimental group for the purposes of control.

The sample, therefore, contained vocational teachers on the secondary and postsecondary levels, blacks and whites, with varying years of experience. The control represented candidates who normally apply and take the NOCTI test series.

Because it was only feasible to test a limited number of candidates by occupation at any one given time, it was decided to conduct these exams over a period of four weekends.

Out of a population of 686 teachers, 238 candidates participated in the examination experience.

Table 11 provides a summary of the sample for the study by level.

TABLE 11
Sample for the Study by Level

<u>Level</u>	<u>Number</u>
Postsecondary	146
Secondary	73
Adult	5
<u>Missing Data</u>	<u>14</u>
Total	238

Conclusion

Because of the sampling technique used, the findings of the study can be inferred to apply to the population of vocational - technical teachers in Georgia as a whole.

ANALYSIS #8 - Determining the Independence of the NOCTI Tests

Purpose

To demonstrate the independent nature of each of the NOCTI examinations, an analysis of variance was performed based on test score results on written and performance examinations in the 16 occupations included in the study in Georgia.

Table 12 summarizes the results of the analysis.

TABLE 12

TEST OF INDEPENDENCE OF NOCTI EXAMS

ANOVA Table for Written Tests

Groups	Sum of Squares	df	Mean Squared
Between	14182.937	17	834.290
Within	22532.000	219	102.836
Total	36714.937	236	
F Test	8.109	sig cv .01 *	
	Test of Linearity		
F Test	8.178	sig cv .01 *	

ANOVA Table for Performance Tests

Groups	Sum of Squares	df	Mean Squared
Between	24913.822	17	1465.519
Within	35081.506	213	164.702
Total	59995.328	230	
F Test	8.898	sig cv .01 *	
	Test of Linearity		
F Test	7.632	sig cv .05 *	

* Level of significance derived from standard "F" Tables

Conclusion

The results of the analysis of variance demonstrated the independent nature of the 16 tests, both written and performance. The measures of independence were significant at the .01 level. This finding supports the uniqueness of each of the 16 NOCTI written and 16 NOCTI performance tests based on their independent characteristics, developed through occupational job analysis.

ANALYSIS #9 - Analysis of Variance by Race

Purpose

To determine whether or not significant differences exist between white and black candidates on the written and performance tests, a one-way analysis of variance was performed.

Findings

The data revealed that insofar as the written examinations go, blacks score significantly lower than whites. In terms of the performance tests, no significant differences were uncovered. Tables 13 summarizes these findings.

TABLE 13

COMPARISON OF MEAN SCORES OF NOCTI TESTS BY RACE

	Written		Performance	
	Black	White	Black	White
Size	39	186	38	182
Mean	59.48	67.19	79.58	80.16
F Test	12.802	sig cv .01	.041	not sig

Conclusion

As a result of these analyses, the NOCTI written examinations in Georgia tend to underestimate the true scores for black candidates who are comparable in terms of their performance scores to white candidates.

ANALYSIS #10-Analysis of Variance by Level

Purpose

In order to determine whether or not significant differences existed between candidates depending on what level they taught, (secondary, postsecondary), an analysis of variance was applied.

Findings

The data revealed that in regard to the written examination, secondary teachers scored significantly lower than postsecondary teachers at the .05 level. In terms of the performance test, no significant differences were uncovered. Table 14 describes these comparisons by level.

TABLE 14
COMPARISON OF MEAN SCORES ON NOCTI TESTS BY LEVEL

	Written		Performance	
	Sec	Postsec	Sec	Postsec
Sample	67	149	64	147
Mean	62.94	68.12	77.16	82.26
F test	4.344	sig cv .05	2.774	not sig

Conclusion

The data revealed that significant differences existed between secondary and postsecondary teachers in terms of the written examination. Depending on how these exams are to be used, such information would have pertinence. For example, if one criterion were to be used as a measure of acceptable performance on the written test, the lower mean score would have to be applied. This would provide a candidate with a measure of eligibility, but would not necessarily insure employment. Selection for employment might be made, for example, on additional criteria related specifically to jobs in question.

ANALYSIS #11-Two-Way Analysis of Variance; Race and Level

Purpose

Having uncovered significant differences between race and written tests scores along with level and written test scores, a two-way analysis of variance was performed to see if these two effects were independent. Was there a significant interaction between race and level? Explanation of the variance would help in terms of what actions would be called for to account and adjust for the differences uncovered.

Findings

These tests reaffirmed the independent nature of the significant main effects (race and level), with combined effects (race x level) being non significant. Tables 15 and 16 present these findings.

Conclusion

The significant differences found earlier for the main effects of race and level on the NOCTI written tests are supported. In addition, a significant difference based on level was also uncovered for the performance tests.

TABLE 15

ANALYSIS OF VARIANCE BASED ON WRITTEN TESTS BY RACE AND LEVEL

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main Effects	2499.089	2	1249.544	8.762	.001***
Race	1407.297	1	1407.297	9.868	.002**
Level	916.029	1	916.029	6.423	.012*
2-Way Interactions	31.409	1	31.409	.220	.999
Race Level	31.409	1	31.409	.220	.999
Explained	2530.498	3	843.499	5.915	.001***
Residual	29234.411	205	142.607		
Total	31764.909	208	152.716		

NOTE:

238 cases were processed.

29 cases (12.2 percent) were missing

* sig at .05

** sig at .01

*** sig at .001

TABLE 16

ANALYSIS OF VARIANCE BASED ON PERFORMANCE TEST SCORES BY RACE AND LEVEL

Source of Variation	Sum of Squares	DF	Mean Square	F	Sig of F
Main effects	1171.793	2	585.897	2.520	.081
Race	26.644	1	26.644	.115	.999
Level	1119.394	1	1119.394	4.815	.028*
2-Way Interactions	14.646	1	14.646	.063	.999
Race Level	14.646	1	14.646	.063	.999
Explained	1186.439	3	395.480	1.701	.166
Residual	46497.062	200	232.485		
Total	47683.501	203	234.894		

NOTE:

238 cases were processed.

34 cases (14.3 percent) were missing.

* sig at .05

ANALYSIS #12-Application of National Norms

Purpose

The purpose of this analysis was to determine the possible use of national norms for ranking Georgia test scores.

Approach Used

The mean scores from the sample of 16 test groups were compared to national norms by means of a "t" test. This test uncovered that significant differences do, indeed, exist in 5 of the 16 written examinations. An analysis of 3 of these tests, Auto Body, Auto Mechanics, and Masonry, revealed that a higher number of blacks had taken these exams as compared to the other test series. It had been estimated, that the mean score difference between black and white candidates was approximately 6 percentage points. This value, when adjusted for the number of blacks who took the exam, and introduced into the model, cancelled out this difference. In other words, the significant differences which were found initially, cancelled out.

Findings

In applying this correction factor to scores obtained from the Georgia sample, in cases where the blacks in the sample were equal to or greater than one-third of those tested, the significant differences, which were found originally, did not reappear. With its application, in 14 out of the 16 NOCTI written tests used, national norms were found to apply. In one case, Cosmetology, the sample means were significantly higher, which would also indicate that national norms would not have any negative affects on Georgia candidates taking this test. Only on the Welding test were the mean scores of the Georgia candidates significantly lower than national norms. In this case, the effects of black candidates did not appear large enough to account for this difference.

This difference will need to be studied further to determine whether it was a true difference or just a chance occurrence. Table 17 summarizes the comparison of Georgia scores on written tests to national norms, including the test for adjustment of selected written tests due to race.

TABLE 17

GEORGIA WRITTEN SCORES COMPARED TO NATIONAL NORMS

Test	Sample Mean	Norm	"t"	Level of Sig.
ACON	69.7	68.5	.494	
ARCHD	67.0	65.1	.638	
ABODY	62.7	70.3	-2.234	*
AMECH	60.5	65.8	-3.057	**
CARP	69.8	73.1	-1.488	
COSMO	76.3	72.2	2.025	*
DIENG	67.3	67.8	- .117	
ESTAL	53.8	54.1	- .115	
ELCOM	73.0	70.0	.760	
IERAN	71.3	69.2	.387	
IERIC	62.3	60.8	.292	
MACHD	76.6	73.1	1.324	
MACHT	56.7	57.9	- .496	
MASON	71.6	77.0	-1.971	*
PRINT	50.3	48.5	.292	
WELD	54.0	60.9	-2.642	**

ADJUSTMENTS OF SELECTED WRITTEN TESTS DUE TO RACE

ABODY	64.7	70.3	-1.646	N.S.
AMECH	62.5	65.8	-1.904	N.S.
MASON	74.6	77.8	-1.240	N.S.

NOTE: The mean scores on the Cosmetology test was significantly higher than the standard. The mean score on the Welding was significantly lower.

Conclusion

With an adjustment factor on written examinations for blacks, the national norms for written tests appear to apply. The average mean difference across all tests, (average mean score white minus average mean score black equals average mean difference), when added to test scores of black candidates, cancelled out the significant differences. The study revealed this difference to be 7.7 percent (see Table 13)

Comparison of Georgia Performance Scores to National Norms

An analysis of the mean scores obtained by the sample of Georgia candidates revealed that in 9 of the 16 tests, significant differences were found when compared to national norms. In 7 of these 9 cases, the mean scores were higher and, therefore, the use of national norms would not present a problem. Two tests were found to be significantly lower. These were Cosmetology and Welding, both significant at the .05 level. This relationship is consistent with the differences found on the written test scores and may indicate the uniqueness of a particular sample tested, rather than differences attributable to the examinations. Table 18 describes these measures. Since no significant differences were found between black and white candidates on performance tests, no adjustment of these scores appears warranted. National norms for the performance tests, therefore could be used to rank Georgia candidates.

Predicting Written Scores from Performance

In another approach to analyzing predictive implications of scores, a multiple regression correlation coefficient, was used. It was found that the correlation coefficient between the performance test series and the written test series is equal to .237. Although, this correlation is significant in terms of sample size, the level of explained variance is so low (.05) as to give it little practical value in terms of predicting written scores from performance.

TABLE 18

GEORGIA PERFORMANCE SCORES COMPARED TO NATIONAL NORMS

Test	Sample Mean	Norm	"t"	Level of Sig.
ACON	93.3	82.3	4.966	**
ARCHD	71.0	78.5	-1.652	
ABODY	97.1	83.6	5.844	**
AMECH	84.4	78.3	2.452	**
CARP	62.5	62.3	.412	
COSMO	73.1	77.6	-2.138	*
DIENG	84.5	80.0	2.705	**
ESTAL	88.5	71.7	4.419	**
ELCOM	90.5	85.8	1.911	
IERAN	73.8	83.1	-1.131	
IERIC	83.4	72.0	2.040	*
MACHD	84.7	73.6	3.856	**
MACHT	65.0	68.4	-.614	
MASON	76.1	77.7	.271	
PRINT	80.7	74.0	1.675	
WELD	67.6	77.8	-2.016	*

NOTE: In 7 out of the 9 tests, the Georgia sample scored significantly higher than the standard. In 2 cases, Cosmetology and Welding, the difference was found to be significantly lower.

ANALYSIS # 13 - Other Relationships

Purpose

The purpose of this analysis was to uncover what relationships exist between selected demographic variables and the occupational competency tests used. This was due as an aid in decision making in terms of future application of the NOCTI test series in Georgia.

Approach Used

The measures of relationship were determined through the use of Pearson Correlation Coefficients. Test scores were compared with education achievement levels, years of experience, level currently working on (secondary, postsecondary) and race. A correlation matrix was developed through the use of a computer program, which enabled the investigators to study the relationships between all of the combinations of the 6 variables involved.

Findings

Several significant correlations were uncovered. These are reported in Table 19. Significant positive relationships were found between written test scores and education, written test scores and level, and written test scores and the performance test. A significant negative correlation was uncovered between written test scores and race. Performance test scores correlated significantly with level, level correlated significantly with experience, and experience correlated significantly with race. Although, significant correlations were uncovered, the level of relationships is low and therefore are seen only as supportive and explanatory of other findings.

Discussion

The analysis revealed that the more education candidates seemed to have, the higher were their test scores on the written test. However, the amount of education did not have any effect on performance scores. The significant negative correlation uncovered between written test scores and race, tends to provide additional support for the finding that blacks tend to score lower than whites on the written tests. (See Analysis #8, ANOVA by Race) The fact that the correlations between performance test and race were not significant, also tends to support the unbiased nature of the performance test instruments.

The findings, which were correlated positively between written test scores and level, performance test scores and level, and level and experience, tend to support the findings described in Analysis #10, ANOVA by Level. Those candidates who took the examinations from the postsecondary schools, tend to have a greater experience and score significantly higher on the written tests. The Pearson Correlation was found to be significant when describing the

relationship between the performance test and level. However, the relationship was not apparent in the more stringent ANOVA test described in Analysis #10 and, therefore, should not be considered reflective of a pertinent difference.

Conclusion

The previous reported conclusions tend to be supported as a result of these analyses, that is, real differences exist between black and white candidates in Georgia who took NOCTI written tests, while no real differences were uncovered on the performance test. Postsecondary teachers who apparently have greater experience, irrespective of race, tend to do better on the written examinations.

TABLE 19
RELATIONSHIPS BETWEEN SELECTED VARIABLES

Y	X	Sample	Pearson's r	Sig Level
Written test scores	Education	237	.215	.001
	Experience	228	.021	
	Level	216	.196	.01
	Performance	231	.237	.001
	Race	225	-.233	.001
Performance test scores	Education	231	.061	.01
	Experience	223	.039	
	Level	211	.152	
	Race	220	.014	
Education	Experience	229	-.014	
	Level	217	-.062	
	Race	226	-.041	
Level	Experience	213	.127	.05
	Race	210	-.068	
Race	Experience	222	.218	.001

NOTES: Y = Dependent Variables
X = Independent Variables

ANALYSIS # 14

Comparison of Written Scores Based on Items Judged Essential

Purpose

The purpose of this analysis was to compare the scores achieved by candidates based on items that were judged ESSENTIAL by experts to their total written test score results. This was done to see if a special subscore routine would have to be introduced for evaluating candidates in order to establish minimum acceptable competency levels.

Approach Used

Each written test was rescored using only the items judged essential. Essential is defined as an item receiving a measure of 2.5 or greater on a scale with a maximum of 3. Pearson's Product Moment Correlation Coefficients were used to test the relationship between the sets of scores. In addition, an ANOVA test was performed to see if the finding of significant differences on the written test based on race still held. This comparison was made using only those items judged essential. (See Analysis #9)

Findings

The 16 correlations were found to be extremely high and all were significant. All measures also showed extremely small standard errors. The significant differences described earlier in this report related to scores of black candidates on the written tests, continued to be in evidence. The mean for white candidates using the essential measures was found to be 69.06 as compared to 61.81 for black candidates. This difference is significant at the .01 level.

Conclusion

The NOCTI examinations can be used as an indication of a candidates competencies. These measures would be Norm referenced. On the other hand, the items identified as essential by judges could form the basis of a unique criterion referenced indicator of mastery.

Table 20 summarizes the findings.

Table 20

Comparison Between Essential Items Score
and Total Score on NOCTI Written Test

<u>TEST</u>	<u>T</u>	<u>E</u>	<u>I</u>	<u>r</u>	<u>SE</u>	<u>Sig</u>
Air Conditioning and Refrigeration	165	138	.836	.972	.532	.001
Architectural Drafting	150	130	.898	.971	.469	.001
Auto Body Repair	150	121	.807	.990	.500	.001
Auto Mechanic	200	168	.840	.989	.253	.001
Carpentry	159	142	.893	.988	.331	.001
Cosmetology	120	87	.725	.954	.521	.001
Diesel Engine Repair	167	115	.689	.977	.789	.05
Electrical Installation	177	120	.678	.932	.951	.001
Electronics Communication	130	127	.977	.968	.947	.001
Industrial Electrician	200	172	.860	.993	.577	.001
Industrial Electronics	150	85	.567	.997	.499	.001
Machine Drafting	155	102	.755	.985	.401	.001
Machine Trades	160	130	.812	.962	.655	.001
Masonry	100	75	.750	.893	1.044	.001
Printing	131	77	.588	.967	1.539	.05
Welding	155	143	.922	.995	.279	.001

Key: T = Total Test Items

E = Items Judged Essential by Experts

I = Index of Essentiality = E/T

r = Pearson Product Moment Correlation Coefficient

SE = Standard Error

Sig = Level of Sig

NOTE: The mean score across all written tests for white candidates using the essential measure was found to be 69.06 as compared to 61.81 for blacks. These differences were tested by a One-Way Analysis of Variance, and were found to be significant at the .01 level.

SECTION 4

Summaries of Analyses

Implications

Estimated Budget

Role and Function Chart

Summaries of Analyses

Analysis #1- The overall content and performance tasks of 16 written and performance tests were evaluated by a committee of experts using 7 broad categories for each occupational area, and were judged to meet the standard for adequacy. Only 2 of the 122 categories tested failed to achieve the criterion of adequacy.

Analysis #2- The same committees reviewed the written and performance examinations for their appropriateness and adequacy regarding the subheading topics, which were developed through job analysis. The review of the subtopics and their respective weightings in each occupation were judged to be appropriate and adequate for Georgia.

Analysis #3- The committees also assessed the adequacy of each written test item. Of the 2449 items, only 3 failed to meet the appropriate standard. Note: Analyses #1-3 were conducted for the purpose of determining the content validity of the NOCTI examinations for Georgia.

Analysis #4- Measures of reliability were obtained for the 16 NOCTI written tests. These measures revealed that the NOCTI written tests show high reliability with low standard errors of these measurements.

Analysis #5- A determination of the grade reading level of each of the NOCTI written tests was made, which revealed an average reading level of NOCTI tests to be equivalent to the 9.4 grade level with one exception, Mechanical Technology, which has a reading level lower than what might be expected. All written tests appear to meet an appropriate standard for reading level.

Analysis #6- To comply with requirements of the Federal Employment Opportunity Commission, all trade and technical teachers in Georgia, in the 16 study occupations, were asked to compare the emphasis they give to selected topics included in the NOCTI exams to the emphasis assigned these topics through job analysis. This analysis revealed that substantial agreement exists between what teachers are expected to perform in the shop and classroom as part of their job, and the material covered on the NOCTI examinations.

Analysis #7- The current population of trade and technical teachers in Georgia was identified, and specific demographic data was obtained in order to randomize this population based on specific characteristics. Out of this procedure, samples were drawn by occupation, level (secondary, postsecondary), race, and years of teaching experience. Teachers who were identified through this sampling procedure, were invited to Atlanta to participate in the pilot testing of the NOCTI examinations. Candidates who normally take the examination in Georgia were included in the test population as a control.

Analysis #8- This analysis was performed to demonstrate the independent nature of each of the 32 examinations employed in this study. The data confirmed the uniqueness of each test.

Analysis #9- Tests were run to compare scores achieved by black candidates and white candidates. These tests revealed that there were differences for white and black candidates on the NOCTI written tests. However, no significant differences due to race were found on the performance tests.

Analysis #10- The achieved scores of secondary and postsecondary teachers on the written and performance tests were compared to see if differences existed based on level. Postsecondary teachers as a group, scored higher on both the written and performance tests. However, only on the written test do these differences appear to warrant additional attention.

Analysis #11- Having uncovered significant differences due to race and level, a 2-way analysis was undertaken to see if the combined effects were interactive. No significant interactions were uncovered as a result of this test.

Analysis #12- This analysis was undertaken to determine whether or not national norms could be used for the purpose of ranking candidates based on their test scores. The analysis revealed that the national norms for NOCTI written and performance scores appear to be appropriate.

Analysis #13- Relationships between selected demographic variables and the NOCTI tests were studied through the use of a Pearson's Correlation Coefficient. Several significant relationships were uncovered, which were consistent with other findings. The level of relationship, however, was found to be low. This analysis is included principally for supportive and explanatory reasons.

Analysis #14- A partial score, based on items judged essential by experts, was correlated with total test scores of candidates. The items identified by the experts represented understandings which competent persons in each occupation, should know. Significant positive relationships were revealed which suggest that either scale, Criterion or Norm referenced, may be used to assess teacher competency in their occupational skilled craft area.

Implications

The following implications arise as a result of the work performed under the terms of the Vocational Competency Testing Project:

1. Continued use of the NOCTI tests and national norms, as a part of a Vocational Teacher selection process, appears to be warranted.

The analyses performed demonstrated that the NOCTI tests were valid and reliable and that the national norms appear to apply. Thus, the objectivity of the instruments has been demonstrated, indicating that these instruments are appropriate for their intended application in Georgia.

2. Various approaches to determine cut-off measures are possible.

The identification of real differences between the scores achieved by black and white candidates on NOCTI written tests, indicates that an appropriate adjustment factor might be included in a norm referenced cut-off measure to reflect a true measure of the candidate's level of accomplishment. If criterion referenced cut-off scores are to be used, then a single cut-off measure for black and white candidates might be established at a level which would appear to meet EEOC standards. Candidates who initially fail to meet a cut-off criterion should be given another opportunity to retake the NOCTI test. However, before re-examining a candidate, a period of at least 6 months should have elapsed.

3. Length and type of experience might be considered in assigning teachers to postsecondary positions.

The achievement of significantly higher scores on the written examinations by teachers in postsecondary programs, as a group, correlates with length and diversity of work experience. Therefore, experience should be used as a significant criterion in considering assignments of teacher applicants.

4. The University of Georgia might be designated as the official agency for the State of Georgia, responsible for coordination and administration of the occupational competency testing program.

The University of Georgia has, for several years, been functioning as a test administrative center for sister institutions in the State. NOCTI has designated the University an official Test Center. Their experience in recruiting candidates, arranging for examinations, interpreting test results, and maintaining records, would facilitate the implementation of an effective statewide program of competency testing in trade and technical fields. This would be consistent with the prevailing practice among the 39 existing NOCTI Test Centers, where all but a few of the centers reside in a university unit. Experience over several years has affirmed the desirability of such university units serving as the operational and evaluation entity for occupational competency testing connected with establishing certification eligibility.

5. The operational principle of one or two central test sites appears to be appropriate for Georgia, with satellite test sites elsewhere in the State to be used as needed.

The experience gained by NOCTI as a result of conducting the pilot tests at a single location, revealed the need for additional test sites. One or two principle test sites will help to provide for a more effective and efficient way to administer tests. When there are strong indicators for holding tests elsewhere, primarily geographic or for occupational areas not available at the primary test sites, satellite test centers can be arranged by the Test Center Coordinator on an "as needed" basis. NOCTI provides assistance with training of test site personnel, as required, as part of its regular program service.

6. Periodic reassessments of candidate test scores should be considered to see if the differences identified in this study remain consistent, or change.

Although the findings in the study are strong, test populations may change over time. Careful monitoring of candidate characteristics, over time, will help assure the validity of test results. Such continuous assessment would assure that the fairness, appropriateness, and adequacy of the system which is being recommended, would be maintained. NOCTI is prepared to assist with the indicated evaluations on a direct cost basis, as requested and in cooperation with the Georgia Department of Education.

7. Consideration is indicated for possible longitudinal studies to ascertain the relationships between scores on competency tests and aggregate job performance as teachers.

It would be desirable to obtain measures of job performance as teachers and relate these to scores achieved on NOCTI examinations. Research attention of this kind would provide measures of predictive validity based on external criteria. Such measures would provide additional support to administrators in making decisions regarding selection of candidates. If possible, another sampling of potential teachers would also help to further determine the consistency of the approach.

8. Consideration might be given to the use of competency testing in other occupational areas such as Agriculture, Business, and Health.

The NOCTI test series currently available does not include important areas such as Agriculture, Business, and Health. Should the State Education Department feel that it wishes to extend competency testing to selected occupations in these areas, then new developmental funds would be needed for the construction of instruments. NOCTI is interested in such developments and would become a mutual participant. New competency tests are currently being prepared by NOCTI in areas such as Computer Technology and Building Trades Maintenance. Development of other test areas have also been authorized.

9. An initial allocation is indicated in order to establish a revolving fund for conducting the occupational competency testing program.

NOCTI tests are made available on a unit fee basis. A portion of the fee is returnable to the Test Center to defray costs of examiners, consumable supplies, and other costs incidental to the conduct of the examinations, primarily those connected with the performance tests. The costs reimbursable to the Test Center are identified in the NOCTI Handbook for Area Test Center Organization and Administration.

Since costs of conducting NOCTI examinations vary significantly by volume of candidates, an estimated budget is attached. In this model, should the state decide to finance the total program for conducting occupational competency tests, \$34,000 annually or an average of \$170 per candidate would be required. This includes, in addition to the current \$100 NOCTI fee, an estimate of \$20 for test administration and \$50 for candidate's travel. Following are the alternatives for deriving the requisite funds, in the order of frequency, applied by the NOCTI Test Centers elsewhere in the country.

- a. The candidate pays a \$100 fee plus his transportation, and the Test Center provides the additional funds, as needed, to support the direct and indirect costs of the testing program.
- b. The candidate pays the entire estimated cost of conducting the examination (in this instance \$120 per examination) and \$50 for transportation to test sites.
- c. The candidate pays a pre-determined fee (less than \$100) and the difference between the fee and actual cost is contributed by the Test Center (State of Georgia).

10. A summary of this report should be shared with all vocational educators in Georgia.

Sharing the results of this project with all of the trade and technical teachers in Georgia will provide a needed feedback which should result in higher acceptance of the application for which these tests are planned. The teachers of Georgia have made important contributions to this project and their efforts should be recognized.

This study has demonstrated that the NOCTI examinations provide for an objective way to evaluate occupational competency in selected areas. The continuing use of objective measures will permit those individuals who have acquired the necessary knowledge and skills to find meaningful roles as teachers in the State's secondary and postsecondary vocational and technical schools. Implementation of a valid testing program will help to assure continued compliance with EEOC standards.

A Budget and Function Chart aimed at implementing a vocational competency testing program in Georgia follows:

Estimated New Funds Required for Operating
A Vocational Teacher Competency Testing
Program in Georgia for 200 Candidates Annually

<u>Item</u>	<u>Costs</u>
1. Coordinators	\$ 1,600
2. Travel for Coordinators	800
3. Clerical (1/4 time)	2,000
4. Postages & Duplication	500
5. Fees for Examiners	
a. Written	1,400
b. Performance	2,500
6. Materials for Performance Tests	2,000
7. Fee for Plant Usage	1,200
8. Cost of 200 tests from NOCTI	20,000
9. Total Costs	\$32,000
10. Less Reimbursement from NOCTI	-8,000
11. Net Cost	\$24,000
12. Travel & Subsistence for Candidates	10,000
Total	\$34,000

Budget Notes:

1. A basic fee of \$100 is charged by NOCTI for each examination (Written and performance) and supporting test services. Of this amount, based on formulas for reimbursement (NOCTI Handbook for Area Test Center Organization and Administration) an average of \$40 per examination is returnable to the test center in connection with honoraria to examiners, cost of consumable supplies, and other cost for conducting the program as referenced in Budget items 1-7. However, actual cost in these items is estimated to be higher than the reimbursement allowance by an average amount of \$20 per examination.
2. Some states participating in the NOCTI program now add an additional charge to the NOCTI examination fee, to cover all or some of the indirect costs associated with the conduct of a testing program.
3. Although the cost of transportation and subsistence for candidates is included in the budget, it is common practice in other states for candidates to assume these costs.
4. \$120 per candidate should cover all costs associated with the test program, with the exception of candidate costs involved in traveling to a test site.
5. Should the state desire to pay a specific test fee to NOCTI and waive reimbursement, then a special letter of agreement would be required. Such an agreement would include provisions for credit for candidates who take only the written portion of a test. Such credits would be automatically applied against ensuing test purchases, on a continuing basis.

Functions of Key Organizations in Occupational Competency Testing Program

State Education Department:

1. Establishes standards.
2. Promulgates certification requirements to include NOCTI testing.
3. Refers inquiries for testing to University of Georgia.
4. Certifies competency through issuance of certification.
5. Promotes new test development (Revolving Fund Concept).
6. Through legislation, helps to establish a statewide network of test sites.

University of Georgia, Athens

Serves as official NOCTI Test Center for the State, and:

1. Provides test program administration.
2. Handles inquiries from candidates & test sites.
3. Arranges for tests in accordance with appropriate standards and procedures.
4. Reports scores to appropriate agencies and individuals.
5. Maintains appropriate records.
6. Disseminates information for testing to candidates and the public of Georgia.
7. Provides for special services, ie. research & evaluation.

National Occupational Competency Testing Institute:

1. Supplier of test materials.
2. Scoring of tests.
3. Reporting of scores to the test center.
4. Record maintenance.
5. Preparation of norms.
6. Provides support in test development and research.

NOTES:

1. Written tests would be administered on an as needed basis through the University of Georgia in cooperation with selected area vocational-technical schools as principal test sites. The remaining area vocational-technical schools may be used as satellite test sites, as needed. Other suitable facilities in secondary and junior college programs may also be considered as potential satellite test sites, as required. Certified guidance personnel in these schools should be authorized to administer these written tests.
2. Performance test will be conducted quarterly.

APPENDIX

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Appendix "A"

Number of Judges by Occupation

<u>LIST OF OCCUPATIONS</u>	<u>Number of Judges Used in Analysis</u>
1. Air Conditioning and Refrigeration	6
2. Architectural Drafting	6
3. Auto Body Repair	5
4. Auto Mechanic	6
5. Carpentry	5
6. Cosmetology	6
7. Diesel Engine Repair	5
8. Electrical Installation	6
9. Electronics Communications	5
10. Industrial Electrician	3
11. Industrial Electronics	4
12. Machine Drafting	3
13. Machine Trades	5
14. Masonry	6
15. Printing	4
16. Welding	4

Judges - Georgia - Content Validation Study

<u>NAME</u>	<u>EMPLOYER</u>	<u>OCCUPATION</u>	<u>LEVEL</u>
Joe C. Garrison Instructor	Dekalb Community College	Air Conditioning & Refrigeration	Post-Secondary
W. G. Hartline Asst. Director	Columbus Tech.	"	Post-Secondary
Billy D. Martin Instructor	Dekalb (OEC)	"	Secondary
Randal Reid Electro Mechanical	Douglas Co. Comp High School	"	Secondary
Gene Smith Instructor	Athens Area Tech. School	"	Post-Secondary
J. Alvin Wilbanks Director	Dekalb Co. Board of Education	"	Secondary
Garland K. Winders Voc. Supervisor			
David Acuff Instructor	Coosa Valley Vocational High School	Architectural Drafting	Secondary
Gerald Allen Coord, Instructor	Pickens V-TS	"	Post-Secondary
Ralph Dawson Instructor	Atlanta Tech.	"	Post-Secondary
Floyd McKnight Instructor	Ben Hill Irwin Tech.	"	Post-Secondary
Thomas Poe Director	Coosa Valley Vocational High School	"	Secondary
Charles E. Tyner Instructor	Calhoun High School	"	Secondary

<u>NAME</u>	<u>EMPLOYER</u>	<u>OCCUPATION</u>	<u>LEVEL</u>
George Luther Instructor	Dekalb O.E.C.	Auto Body Repair	Secondary
Lester Ranew Instructor	Griffin Tech.	"	Post-Secondary
David Spencer Instructor	Gwinnett Career Center	"	Secondary
Robert Strange Instructor	Upton Vocational School	"	Post-Secondary
James Wilbanks Director	Occupational Education Center	"	Secondary
Prentiss Brown Instructor	Ben Hill Irwin AVTS	Auto Mechanics	Post-Secondary
Judson Dye Instr. Coord.	Dekalb Tech.	"	Post-Secondary
James Harris Voc. Super.	Forsyth High School	"	Secondary
Curtis Thompson Instructor	Forsyth High School	"	Secondary
Charles Whitehead Instructor	L. Tech.	"	Post-Secondary
Donald Wooley Instructor	Houston Vocational	"	Secondary
Charley Chadwick Instructor	Calhoun High School	Carpentry	Secondary
Steve Higgins Instructor	Griffin AVTS	"	Post-Secondary
Ellis Hite Voc. Super.	Calhoun High School	"	Secondary
C. L. Hollomon Instructor	Houston Vocational Center	"	Secondary
Charles Horton Coord. Instru.	Griffin AVTS	"	Post-Secondary
James A. Webb Instructor	Troup Tech.	"	Post-Secondary

<u>NAME</u>	<u>EMPLOYER</u>	<u>OCCUPATION</u>	<u>LEVEL</u>
Wansley Bramblett Instructor	Forsyth Co. Comp. High	Cosmetology	Secondary
Leon B. Duke Chairman/Instructor	Atlanta Area Tech.	"	Post-Secondary
Irene I. Fowler Teacher	Gwinnett County Board of Education	"	Secondary
Carole N. Martin Instructor	Upton Co. Area Vocational Tech. School	"	Post-Secondary
William G. Montrois Coord. of Instruction	Atlanta Area Tech.	"	Post-Secondary
Garland K. Winders Voc. Supervisor	Rockdale Co. High School	"	Secondary
Robert J. Busby Instructor	S. Georgia Tech.	Diesel Engine Repair	Post-Secondary
Nathaniel Cross	Albany Vocational School	"	Post-Secondary
Jack N. Gay Coordinator	Moultrie Vocational Tech.	"	Post-Secondary
R. L. Sherrill Instructor	Atlanta Tech.	"	Post-Secondary
S. W. Smith Instructor	Dekalb Tech.	"	Post-Secondary
Loyal Harris Voc. Supervisor	Walton High School	Electrical Installation	Secondary
John Hinton Instructor	Dekalb Community College	"	Post-Secondary
Wendell Hooms Instr. Coordinator	Carroll Vocational Tech.	"	Post-Secondary
R. Dennis Johnston Instructor	COOSA Vocational High	"	Secondary
Bobby Parrish Instructor	Dekalb O.E.C.	"	Secondary
Joel G. Pitts Instructor	Upton Tech.	"	Post-Secondary

<u>NAME</u>	<u>EMPLOYER</u>	<u>OCCUPATION</u>	<u>LEVEL</u>
Lawrence H. Bond Coord. Instructor	Lanier Tech. School	Electronics Communications	Post-Secondary
David Goodroe Instructor	Gwinnett Education Center	"	Secondary
John Hooper Director Voc. Ed.	Franklin High School	"	Post-Secondary
J. N. Ray Elec. Instructor	Athens Tech.	"	Post-Secondary
Gene Smith Instructor	Griffin Vocational School	"	Post-Secondary
Victor L. Talmage Instructor	Houston Vocational Center	"	Secondary
Sammy Hannah Instructor	Carroll Tech.	Industrial Electrician	Post-Secondary
Lloyd Harris Instructor	L. Tech.	"	Post-Secondary
Robert E. Mosely Instructor	Macon AVTS	"	Post-Secondary
Marion Cornett Instructor	Atlanta Tech.	Industrial Electronics	Post-Secondary
Jerry D. Gay Instructor	Upton Vocational School	"	Post-Secondary
Tom Harrison Instructor	Pickens Tech.	"	Post-Secondary
B. L. Henderson Coord. Adult Inst.	Albany Tech.	"	Secondary
Ronny Blackstock Instructor	Upton Tech.	Machine Drafting	Post-Secondary
Jan Erb Instructor	Gwinnett Career Center	"	Secondary
Pat Harrison Instructor	Pickens Tech.	"	Post-Secondary

<u>NAME</u>	<u>EMPLOYER</u>	<u>OCCUPATION</u>	<u>LEVEL</u>
Quentin Aaynes	Calhoun High School	Machine Trades	Secondary
Dewey Carter Instructor	Coosa Valley Tech.	"	Post-Secondary
Grover Ellis Instructor	Jordan Vocational High	"	Secondary
Eugene Peyton Instructor	N.G.T.V.S.	"	Post-Secondary
Radford Talley Voc. Super.	Cedartown High	"	Secondary
Robert Vaughan Instructor	Macon Vocational Technical School	"	Post-Secondary
Weston W. Brown Instructor	Newton High School	Masonry	Secondary
George Dalusky Asst. Director	Atlanta Tech.	"	Post-Secondary
Dan A. Dixon Instructor	N. Georgia Technical/ Vocational School	"	Post-Secondary
Lee Morris Constru. Instructor	Cedartown High	"	Secondary
Larry S. Ward Voc. Super.	Cedar Shoals High	"	Secondary
W. L. Williams	Atlanta Tech.	"	Post-Secondary
L. E. Brewer Instructor	Douglas High School	Printing	Secondary
Buford Deal Instructor	Gwinnett Career Center	"	Secondary
Mary Lynn Kreuz Voc. Super.		"	Secondary
George Sanders Instructor	Macon Vocational Tech.	"	Post-Secondary

<u>NAME</u>	<u>EMPLOYER</u>	<u>OCCUPATION</u>	<u>LEVEL</u>
Alvin Cagle Instructor	Pickens Vocational Tech.	Welding	Post-Secondary
William Harris Instructor	Upton Tech.	"	Post-Secondary
John Layfield Instructor	Cedartown High	"	Secondary
William L. Peck Teacher	Dekalb O.E.C.	"	Secondary
Dick Schneider Voc. Super.	Newton Comp. High	"	Secondary

In the listing above, the data submitted by 5 of the judges was withdrawn from the analysis due to missing elements of data, one each in the following occupations:

- Air Conditioning
- Carpentry
- Electronic Communications
- Machine Trades
- Welding

NATIONAL OCCUPATIONAL COMPETENCY TESTING INSTITUTE

OVERALL EVALUATION

Scope of Examination in _____

In this part of the evaluation apply your best judgement on the items listed below, using the following rating scale:

1. Inadequately
2. Not quite adequately
3. Adequately
4. More than adequate
5. Much more than adequate

Enter the rating number (from 1 to 5) in the right hand column.

Please indicate any personal judgements not covered in the evaluation form, in the space under comments.

WRITTEN TEST:RATING

- | | |
|---|-------|
| 1. The Scope covers the technical and trade knowledge and practices expected of a vocational teacher in Georgia. | _____ |
| 2. The Scope covers the related information (science & mathematics a competent vocational teacher uses in his work. | _____ |
| 3. The Scope covers the auxiliary-personal occupational skills a competent vocational teacher applies to his work. | _____ |

PERFORMANCE TEST:

- | | |
|---|-------|
| 1. The tasks selected are typical of those performed by competent vocational teachers in Georgia. | _____ |
| 2. The descriptions of skills, methods and procedures required for the tasks are representative of those used by competent vocational teachers in Georgia. | _____ |
| 3. The tasks require understanding of blue prints, specifications, or other forms of directions and standards required of competent vocational teachers in Georgia. | _____ |
| 4. The range of trade information and skills is representative of those expected of a competent vocational teacher in Georgia. | _____ |

COMMENTS: Please record any personal judgements not covered by the statements above.

Signature: _____

NATIONAL OCCUPATIONAL COMPETENCY TESTING INSTITUTE

EVALUATION FORM

for the Scope of Examination in

Machine Drafting

Date _____

Name _____

Employer)

or)

Institution) _____

Title _____

OBJECTIVES: The Scopes for the Occupational Competency Examinations have been prepared to enable candidates from industry who wish to become vocational teachers to judge whether they can demonstrate the technical knowledge and manipulative skills expected of a competent worker in the field.

PURPOSE: The purpose of this evaluation is to determine the extent to which the examination content, as described in the Scope, meets the occupational competency requirements of future vocational teachers in Georgia.

PROCEDURE: The occupational competency examinations consist of two parts: written and performance. Each part is divided into specific subheadings. The percentages indicate how much of each subheading is represented in the examination.

Example: Machine Drafting -

Written - Basic Machine Drawing Conventions 7%
This means that 7% of the number of test items cover this subsection.

Performance - Construct from directions, geometric shapes 8%
This means that 8% of the skills on the performance examination will involve this subheading.

INSTRUCTIONS: Based on your experience and knowledge of the occupation, judge whether the informational and manipulative competencies listed in the "Scope" are those expected of a competent teacher in Georgia.

1. If, in your judgement, the indicated percentage weight is appropriate, please check the column so labelled.
2. If you believe the percentage to be too large, indicate in that column what the percentage should be.
3. If you believe the percentage to be too small, indicate in that column what the percentage should be.

Subheadings	Percentage	Percentage Weight is		
	Weight	1. Appropriate	2. Too large	3. Too small
<u>Scope of Written Examination</u>				
Drafting, Instruments, Equipment and Media	15	_____	_____	_____
Basic Machine Drawing Conventions	7	_____	_____	_____
Orthographic Projection and Pictorial Drawings	9	_____	_____	_____
Standard Machined Parts	10	_____	_____	_____
Gears, Cams and Pulleys	10	_____	_____	_____
Interpretation of Drawings	10	_____	_____	_____
Related Mathematical Computations	16	_____	_____	_____
General Drafting Room Procedures	11	_____	_____	_____
Manufacturing Processes/Practices	12	_____	_____	_____
	100			
<u>Scope of Performance Examination</u>				
Redrawing a Working Drawing	35	_____	_____	_____
Construct from directions, geometric shapes	8	_____	_____	_____
Pictorial Presentation	15	_____	_____	_____
Sectional View Presentation	12	_____	_____	_____
Developing a Working Drawing	30	_____	_____	_____
	100			

NOTE: This instrument is representative of the 16 occupations included in the analysis. Each occupation has its own set of subheadings and percentage weight distributions. See Appendix I.

NATIONAL OCCUPATIONAL COMPETENCY TESTING INSTITUTE



WRITTEN TEST - ITEM EVALUATION

Name _____

Occupation _____

Institution _____

KEY:

Position _____

Representing: Secondary Level _____

Post-Secondary Level _____

Indicate, by blackening the appropriate letter, the importance of the item as prerequisite knowledge for a vocational teacher.

A. Essential - must know

B. Should know but not essential

C. Doesn't matter if the teacher knows or not

1 ☐ A ☐ B ☐ C
 2 ☐ A ☐ B ☐ C
 3 ☐ A ☐ B ☐ C
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NATIONAL OCCUPATIONAL COMPETENCY TESTING INSTITUTE

CURRICULUM CONTENT SURVEY FORM

Occupation: Air Conditioning & Refrigeration

Name _____

Type of Program (Check one)

School _____

☐ Secondary☐ Postsecondary

Date _____

☐ Adult

OBJECTIVE: This survey is intended to identify the common elements as well as differences in instructional content for the occupations taught in Secondary and Post-secondary vocational programs in Georgia.

PURPOSE: The purpose of this survey is to enable the vocational teachers to identify those occupational skills and areas of information which actually apply in their daily instructional activities.

The data resulting from this survey will be the basis for curriculum material planning and the development of minimum occupational competency levels for future vocational teachers in Georgia.

PROCEDURES: Listed below are major divisions of your occupation (skills and related information) which are representative of those of a competent worker in your occupation. Read each item carefully. Then indicate, in the corresponding right hand box, your estimate of the percentage of time which you devote to the underlined item in carrying out your instructional responsibility.

If any item is not covered by your instruction, mark 0 in the column.

If there are any major areas in your instruction which are not listed, please list under the heading comments, below, and indicate percentage of time.

MAJOR OCCUPATIONAL DIVISIONS	Percent of Instructional Time
<u>Domestic Systems Installation</u> - Measuring temperatures & pressures; methods of heat transfer; principles of the refrigeration cycle; utilization of proper tools; principles of soldering & welding various tubing connections.	_____
<u>Domestic Systems Servicing</u> - Principles of gauges & thermometers, principles of the compression system; servicing hermetic compressors; construction & operation of relays; motor construction & application.	_____
<u>Commercial System Installation</u> - Principles of refrigeration piping, determining load calculations; operation & principles of metering devices, dehydrators & multiple systems; principles & procedures of evacuating a system; oil characteristics; year-round air conditioning.	_____
<u>Commercial System Servicing</u> - Methods of leak testing, charging & discharging systems; methods & principles of testing electrical systems; servicing & testing metering devices; methods of defrosting, year-round air conditioning.	_____
<u>Residential Air Conditioning & Heating Installation</u> - Comfort standards of heating & cooling; building construction; heat transfer calculations; equipment selection; psychrometrics; air distribution; duct design; National Refrigeration Safety Code.	_____
<u>Residential Air Conditioning & Heating Service</u> - Troubleshooting; compressor replacement; maintenance procedures; system balancing; safety procedures; customer relationships.	_____
<u>Industrial Refrigeration Installation</u> - Building construction; heat gain & loss calculations; equipment selection; blueprint reading; equipment setting; piping techniques; methods of controlling temperature; safety; National Code Requirements.	_____
<u>Industrial Refrigeration Service</u> - Controlled area temperatures & conditions; pressure-temperature-humidity relationships; diagnosing procedures for servicing; lubrication systems; modulating unloaders; functioning of relays, starters, contactors and circuit protection.	_____

COMMENTS: Please record any personal judgements not covered by the statements above.

Signature: _____

SUMMARY OF BASIC DATA OBTAINED AS A RESULT OF THE
GEORGIA VOCATIONAL TEACHER COMPETENCY PROJECT

Air Conditioning and Refrigeration

Candidate	Scores (%)			C	R	Y	E	L	YT
	Ess.	Written	Performance						
1.	52.9	50.9	90.0	C	W	4	15		0
2.	77.8	77.0	97.0	C	W	9	12	PS	4
3.	80.0	78.8	97.5	C	W	25	18	PS	6
4.	60.0	56.4	88.5	C	W	30	15	Sec	2
5.	77.5	79.4	100.0	C	W	18	14	PS	7
6.	60.8	61.2	82.5	C	W		12	Sec	4
7.	50.0	48.0	77.5	C	W	12	12	Sec	4
8.	71.0	69.7	97.0		W	17	13	Sec	3
9.	57.2	58.2	92.0		B	30	15	PS	14
10.	70.8	72.7	94.5		W	2	12	PS	5
11.	80.4	82.4	95.0		W	10	12	PS	2
12.	80.4	81.8	95.0		W	7	16	PS	30
13.	75.4	75.8	95.0	C	W	6	12	PS	4
14.	72.5	73.3	95.0		W	5	12	PS	8
15.	84.0	85.5	95.0		W	10	14	PS	8
16.	76.8	77.0	95.0		W	19	12	PS	1
17.	62.3	59.4	93.5		W	3	14	PS	5
18.	59.4	59.4	95.0	C	W	15	13		2
19.	84.8	75.8	95.0		W	5	12	PS	3
20.	70.3	68.5	95.0	C		34	12	PS	3
21.	70.3	67.9	95.0		W	26	12	PS	M
22.	75.4	73.3	94.5		W	20	14	PS	4

KEY: C = Control

R = Race, B;Black W;White

Y = Years of experience

E = Highest level of education achieved

L = Level of teaching: Sec=Secondary

PS=Post secondary

A=Adult

Ess.= Based on items scoring 2.5 or better by experts.

YT = Years Teaching

M = Missing Data

SUMMARY OF BASIC DATA OBTAINED AS A RESULT OF THE
GEORGIA VOCATIONAL TEACHER COMPETENCY PROJECT

Airframe and Power Plant

Candidate	Scores (%)		C	R	Y	E	L	YT
	Ess.	Written Performance						
1.		72.2	94.0	C	W	22	14	PS 8
2.		69.2	89.9	C	W	8	14	PS M

Architectural Drafting

Candidate	Scores (%)		C	R	Y	E	L	
	Ess.	Written Performance						
1.	58.0	66.7	79.5	C	W	14	12	PS 8
2.	56.7	62.0	79.5		W	4	16	PS 10
3.	60.0	66.7	50.4	C	W	16	14	Sec 1
4.	64.0	71.8	76.3		W	4	18	PS 6
5.	62.7	68.0	46.8		W	8	16	PS 3
6.	59.3	68.7	71.7	C	W	3	12	PS 2
7.	48.7	55.3	67.6	C	W	4	14	Sec 4
8.	59.3	68.7	77.6	C		3	14	Sec 1
9.	71.3	78.7	85.4		W	10	18	A 3
10.	56.0	63.3	74.9	C	W	10	12	PS 0

SUMMARY OF BASIC DATA OBTAINED AS A RESULT OF THE
GEORGIA VOCATIONAL TEACHER COMPETENCY PROJECT

Auto Body Repair

Candidate	Scores (%)			C	R	Y	E	L	YT
	Ess.	Written	Performance						
1.	68.6	66.7	100.0	C	B	6	13	PS	2
2.	62.0	60.0	73.5	C	W	6	10	Sec	2
3.	76.0	69.3	100.0	C	W	7	14	PS	4
4.	27.3	26.0	97.7		B	3	10		M
5.	61.2	56.7	99.9	C	B	25	12	A	5
6.	62.0	61.3	97.7		B	35	15	PS	8
7.	71.9	72.7	99.9		W	8	12	PS	1
8.	79.3	76.0	97.7	C		20	12	PS	3
9.	69.4	68.7	97.7		B	28	12	PS	15
10.	64.5	61.3	95.3		W	10	12	PS	1
11.	80.2	77.3	99.9		W	7	13	PS	2
12.	67.0	65.3	99.9		W	6	12	PS	2
13.	57.8	56.7	99.9		W	30	14	PS	16
14.	60.3	59.3	99.9	C	B	1	12	PS	1

SUMMARY OF BASIC DATA OBTAINED AS A RESULT OF THE
GEORGIA VOCATIONAL TEACHER COMPETENCY PROJECTAuto Mechanic

Candidate	Scores (%)			C	R	Y	E	L	YT
	Ess.	Written	Performance						
1.	57.1	55.5	86.0	C	W		12	Sec	2
2.	50.0	45.5	80.0	C	B	7	12	Sec	2
3.	57.1	51.5	77.5	C	B	29	12	Sec	3
4.	70.2	66.0	81.9	C	W	2	14	Sec	2
5.	60.1	55.0	84.9	C		10	12	Sec	6
6.	65.5	59.5	76.4		B	30	13	Sec	7
7.	48.2	43.0	64.7		B	25	12	Sec	9
8.	67.3	62.5	80.8		B	30	12	Sec	8
9.	53.0	49.5	71.8	C	W	20	13		0
10.	62.5	60.5	74.3	C	B	10	13	Sec	8
11.	64.9	59.5	81.6	C	W	6	12	Sec	8
12.	46.4	46.0	76.2	C	W	25	15		0
13.	50.0	46.0	75.9		B	13	12	PS	4
14.	56.0	53.0	83.2	C	W	7	16	Sec	0
15.	68.4	65.5	89.8		W	16	12	PS	1
16.	65.5	62.0	92.8		B	20	12	PS	9
17.	64.3	60.5	96.3		B	7	13	PS	M
18.	67.3	62.5	79.2		W	11	9	PS	2
19.	72.6	67.0	92.2		W	3	14	Sec	1
20.	69.6	68.0	86.5		W	17	12	PS	2
21.	66.5	63.5	88.4	C	W	3	12	Sec	1
22.	69.6	65.5	90.0		W	20	12	PS	2
23.	68.4	64.0	93.0		W	21	12	PS	;
24.	73.2	70.5	96.0	C	W	6	12	Sec	2
25.	73.8	68.5	83.8	C	W	26	12	PS	9
26.	76.2	72.0	92.8		W	10	12	PS	2
27.	69.6	66.0	91.7		W	13	12		1
28.	69.0	64.5	83.7		W	10	11	PS	2
29.	84.5	81.5	91.7		W	9	12	Sec	3

SUMMARY OF BASIC DATA OBTAINED AS A RESULT OF THE
GEORGIA VOCATIONAL TEACHER COMPETENCY PROJECT

Carpentry

Candidate	Scores (%)			C	R	Y	E	L	YT
	Ess.	Written	Performance						
1.	88.7	87.4	89.6	C	W	3	16	Sec	4
2.	67.0	67.9	88.4	C	W	4	16	Sec	0
3.	61.0	60.4	51.0	C	B	9	12	Sec	3
4.	66.2	62.9	50.6	C	W	22	12	A	3
5.	59.8	58.5	73.5		B	25	12	Sec	4
6.	74.6	74.2	57.7	C	W	20	12	Sec	6
7.	73.2	70.4	83.0	C	W	7	14	PS	1
8.	67.6	69.2	48.1	C	W	9	15	Sec	3
9.	60.6	59.1	60.6		W	15	12	PS	3
10.	80.3	78.0	76.4		W	20	11	PS	2
11.	78.9	78.6	53.5	C	W	20	14	PS	2
12.	64.8	62.9	45.2	C	B	5	14		0
13.	71.1	69.8	48.1		W	10	12	PS	2
14.	71.1	70.4	53.1		W	7	14	PS	2
15.	78.9	77.4	58.1		W	6	12	PS	3

SUMMARY OF BASIC DATA OBTAINED AS A RESULT OF THE
GEORGIA VOCATIONAL TEACHER COMPETENCY PROJECT

Cosmetology

Candidate	Scores (%)			C	R	Y	E	L	YT
	Ess.	Written	Performance						
1.	86.2	82.5	76.3		W	11	12	PS	4
2.	63.2	62.5	65.6		B	22	12	PS	3
3.	67.8	60.0	67.2		W	12	12	A	M
4.	80.4	73.3	71.3		W	1	16	Sec	1
5.	78.2	75.8	71.3	C	W	17	12	A	5
6.	70.1	63.3	71.3	C	B	4	12	Sec	4
7.	92.0	86.7	75.4	C	W	13	12	PS	1
8.	87.3	83.3	70.5	C	W	9	13	PS	2
9.	71.3	67.5	63.1	C	W	21	13	Sec	3
10.	77.0	75.8	81.2		W	5	12	PS	6
11.	82.7	74.2	58.2		W	21	12	PS	6
12.	78.2	75.8	75.4		W	6	12	PS	4
13.	84.0	80.0	71.3		W	3	12	PS	1
14.	88.5	84.2	69.7		W	12	14	PS	3
15.	78.2	71.7	84.5	C	W	4	12	PS	4
16.	86.2	84.2	77.9		W	6	13	PS	2
17.	84.0	80.8	84.5		W	5	12	PS	M
18.	85.0	82.5	72.2	C	W	11	12	PS	5
19.	80.4	72.5	75.4	C	B	22	11	PS	4
20.	81.6	77.5	81.2		W	15	12	PS	3
21.	88.5	87.5	72.2	C	W	11	12	Sec	7

SUMMARY OF BASIC DATA OBTAINED AS A RESULT OF THE
GEORGIA VOCATIONAL TEACHER COMPETENCY PROJECT

Diesel Engine Repair

Candidate	Scores (%)			C	R	Y	E	L	YT
	Ess.	Written	Performance						
1.	72.2	70.7	85.0		W	23	12	PS	14
2.	77.4	73.7	85.0		W	12	15	PS	2
3.	60.9	56.9			W	5	12	PS	3
4.	73.0	67.7	83.5		W	15	11	PS	3

Electrical Installation

Candidate	Scores (%)			C	R	Y	E	L	
	Ess.	Written	Performance						
1.	57.0	55.4	98.3	C	W	6	14	Sec	3
2.	41.7	39.0	87.3	C	W	15	12	Sec	4
3.	58.3	55.4	95.5	C	W	7	12	Sec	3
4.	62.5	57.6	83.2	C	W	33	16	S	11
5.	37.5			C	W	7	12	Sec	2
6.	45.8	52.0		C	W	10	15	Sec	2
7.	70.8	65.5	99.3	C	W	11	11	PS	6
8.	61.7	57.1	97.6	C	W	4	12	PS	3
9.	66.7	64.4	75.5	C	W	16	14	PS	3
10.	63.4	57.6	87.3	C	W	14	12	PS	3
11.	60.8	62.1	95.7		W	8	12	PS	2
12.	40.0	33.3	72.7		W	10	12	PS	M
13.	64.1	57.1	72.0	C	W	10	12	PS	1
14.	52.5	52.5	98.0	C	W	6	12	PS	2
15.	45.0	43.5	88.2	C	W	17	11	PS	11

SUMMARY OF BASIC DATA OBTAINED AS A RESULT OF THE
GEORGIA VOCATIONAL TEACHER COMPETENCY PROJECT

Electronics Communications

Candidate	Scores (%)			C	R	Y	E	L	YT
	Ess.	Written	Performance						
1.	67.5	67.7	96.0	C	W	21	14	Sec	5
2.	76.4	76.2	92.6		W	22	19	Sec	4
3.	52.7	52.3	77.3	C	W	5	12	Sec	2
4.	70.9	70.8	95.4	C	W	20	14	S	8
5.	47.2	47.7	88.4		W	8	12	Sec	1
6.	87.4	87.7	91.5	C	W	18	15	PS	6
7.	63.0	62.3	85.2	C	W	20	15	PS	2
8.	59.0	68.5	88.4	C	W	8	11	PS	8
9.	60.6	60.0	82.7	C	W	10	16	PS	3
10.	89.0	88.5	92.7		W	12	14	PS	2
11.	77.1	67.7	95.1		W	21	11	PS	7
12.	85.0	83.1	93.6			10	12	PS	10
13.	85.8	86.2	91.4		W	8	16	PS	5
14.	90.5	89.2	92.6	C	W	7	13	PS	3
15.	83.8	87.7	95.0	C	W	4	16	PS	2

SUMMARY OF BASIC DATA OBTAINED AS A RESULT OF THE
GEORGIA VOCATIONAL TEACHER COMPETENCY PROJECT

Industrial Electrician

Candidate	Scores (%)			C	R	Y	E	L	YT
	Ess.	Written	Performance						
1.	70.3	70.5	94.6			17	13	PS	2
2.	59.3	58.0			W	3	13	Sec	2
3.	82.0	81.0	77.3		W	30	13	PS	6
4.	86.0	84.0	66.6	C	W	14	13	Sec	1
5.	66.3	63.0	56.6		W	27	11	PS	1

Industrial Electronics

Candidate	Scores (%)			C	R	Y	E	L	
		Written	Performance						
1.	72.9	71.3	97.2		W	10	16	PS	4
2.	82.3	70.0	93.6		W	7	12	PS	12
3.	85.9	76.0	93.5	C	W	24	16	PS	4
4.	51.8	44.0	69.5		B	25	14	PS	11
5.	42.3	34.7	57.7		W	9	12	PS	8
6.	61.2	52.7	85.1		W	16	12	PS	3
7.	80.0	71.3	79.5	C	W	36	16	PS	2
8.	77.6	69.3	97.6		W	7	14	PS	7
9.	81.2	71.3	77.3		W	3	16	PS	4

SUMMARY OF BASIC DATA OBTAINED AS A RESULT OF THE
GEORGIA VOCATIONAL TEACHER COMPETENCY PROJECT

Machine Drafting

Candidate	Scores (%)			C	R	Y	E	L	YT
	Ess.	Written	Performance						
1.	85.3	84.4	81.5	C	W	8	15	PS	5
2.	69.6	65.9	75.4	C	W	3	13	Sec	1
3.	82.3	80.7	86.9	C	W	4	12	Sec	3
4.	75.5	77.0	84.6	C	W	13	17	Sec	10
5.	62.7	61.5	80.0	C	W	2	13	Sec	2
6.	78.4	78.5	84.6	C	W	6	15	Sec	2
7.	76.5	77.0	92.3	C	W	10	16	Sec	5
8.	67.6	65.2	90.7	C	W	6	11		0
9.	71.6	69.6	79.2		W	19	13	PS	10
10.	88.2	85.9	86.9		W	14	16	PS	8
11.	74.5	70.4	86.9	C	W	5	16	PS	12
12.	74.5	73.3	85.4		W	15	14	PS	6
13.	74.5	93.3	81.5		W	28	12	PS	1
14.	94.1	94.1	91.5		W	13	13	PS	11
15.	75.5	72.6	84.6		W	21	15	PS	1

SUMMARY OF BASIC DATA OBTAINED AS A RESULT OF THE
GEORGIA VOCATIONAL TEACHER COMPETENCY PROJECT

Machine Trades

Candidate	Scores (%)			C	R	Y	E	L	YT
	Ess.	Written	Performance						
1.	56.9	50.6	62.8	C	W	12	16	Sec	5
2.	38.5	35.0	49.4		B	15	12	PS	10
3.	60.0	56.3	89.1		W	7	12	Sec	4
4.	72.3	60.0	92.1	C	W	8	14	Sec	3
5.	70.8	66.9	66.5		W	20	12	PS	1
6.	59.2	53.7	10.4	C	W	8	11		2
7.	51.5	48.7	61.0		W	7	12	PS	2
8.	54.6	51.9	76.3	C	W	3	12	PS	3
9.	59.2	51.3		C	W	8	12	Sec	16
10.	76.9	73.7	75.6		W	12	12	PS	1
11.	69.2	61.9	76.3		W	13	12	PS	10
12.	66.9	65.0	58.0		W	8	13	PS	0
13.	62.3	57.5	53.7	C	W	9	12	PS	2
14.	65.4	63.1	62.8		W	20	15	PS	6
15.	64.6	62.5	76.9	C	W	10	12	PS	2
16.	46.9	46.2	51.2	C	W	8	12	Sec	10
17.	73.8	71.2	77.5		W	28	12	PS	6
18.	50.8	45.0					12		7

SUMMARY OF BASIC DATA OBTAINED AS A RESULT OF THE
GEORGIA VOCATIONAL TEACHER COMPETENCY PROJECT

Masonry

Candidate	Scores (%)			C	R	Y	E	L	YT
	Ess.	Written	Performance						
1.	89.3	76.0	65.6	C	W	6	15	Sec	2
2.	72.0	72.0	92.8	C	B	13	14	PS	1
3.	73.3	70.0	92.8	C	B	21	15	Sec	3
4.	78.7	74.0	64.8	C	W	17	13	Sec	4
5.	73.3	67.0	97.6		B	15	12	Sec	9
6.	60.0	59.0	87.2	C	B	18	12	Sec	3
7.	72.0	61.0	39.2	C	W	7	12	Sec	2
8.	56.0	51.0	72.8	C			12		4
9.	77.3	76.0	99.2		B	29	14	PS	3
10.	82.7	82.0	47.2	C	B		12	Sec	3
11.	69.3	68.0	98.4		B	23	12	Sec	5
12.	81.3	84.0	92.8		W	27	11	PS	1
13.	81.3	88.0	96.8		B	17	16	PS	14
14.	76.0	75.0	89.6		B	12	16	PS	4
15.	69.3	63.0	85.6		B	30	13	PS	1
16.	82.7	85.0	80.8		W	40	13	PS	2
17.	85.3	89.0	99.2		W	4	12	PS	2
18.	57.3	58.0	39.2			10	16	PS	28
19.	74.7	73.0	87.2			25	12	PS	2
20.	60.0	58.0	08.8		B	7	12	PS	3
21.	82.7	75.0	60.0	C	W	20	12	PS	2

SUMMARY OF BASIC DATA OBTAINED AS A RESULT OF THE
GEORGIA VOCATIONAL TEACHER COMPETENCY PROJECT

Printing

Candidate	Scores (%)			C	R	Y	E	L	YT
	Ess.	Written	Performance						
1.	59.4	55.0	79.4	C	W	30	12	A	1
2.	39.0	34.1	74.4	C	W	23	12	Sec	.3
3.	58.4	50.4	91.3		B	21	15	PS	11
4.	62.3	61.8	77.5		W	9	13	PS	

Small Engine Repair

Candidate	Scores (%)			C	R	Y	E	L
	Written	Performance						
1.	70.9	88.1		C	W	18	14	Sec
2.	71.5	79.9		C	W	22	12	PS
3.	69.1	93.6		C	W	15	14	

SUMMARY OF BASIC DATA OBTAINED AS A RESULT OF THE
GEORGIA VOCATIONAL TEACHER COMPETENCY PROJECT

Welding

Candidate	Scores (%)			C	R	Y	E	L	YT
	Ess.	Written	Performance						
1.	58.0	57.4	85.1	C	W	5	11	Sec	2
2.	48.9	49.7	53.1		W	14	14		1
3.	58.7	59.4	43.4		W	8	14	Sec	1
4.	33.6	34.2		C	B	4	12	Sec	1
5.	53.8	54.2	49.9	C	W	2	17	Sec	3
6.	58.0	56.8	56.4		W	25	12	Sec	21
7.	58.7	59.4	51.2	C	W	30	12	Sec	8
8.	36.4	36.8	46.9	C	B	3	15	PS	M
9.	37.0	36.7	84.1		W	12	12	PS	3
10.	57.3	54.7	91.6	C	W	9	12	PS	7
11.	62.2	61.3	84.1		W	2	12	PS	2
12.	61.5	62.0	78.6		W	25	11	PS	4
13.	54.5	54.0	66.5		W	16	12	PS	3
14.	63.6	62.0	73.0		W	39	12	PS	5
15.	60.8	60.0	61.3		W	11	12	PS	3
16.	67.8	65.3	88.3		W	15	12	PS	8

TABLE 1

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR AIR CONDITIONING AND REFRIGERATION

AIR CONDITIONING-SEC

ANS	MEAN	DEV	T	Q	NMBR
5	23.788	13.367	8.0743	1.40247-06 **	33
10	20.455	8.9864	6.6831	6.92819-06 **	33
15	4.7879	7.0567	-8.3132	1.10455-06 **	33
20	10.697	12.868	-4.1530	4.32539-04 **	33
15	10.424	10.195	-2.5783	1.40817-02 *	33
20	14.273	13.317	-2.4707	1.80167-02 *	33
5	2.4545	4.0007	-3.6550	1.22829-03 **	33
10	3.2121	5.7160	-6.8218	5.80408-06 **	33

AIR CONDITIONING-POST SEC

ANS	MEAN	DEV	T	Q	NMBR
5	12.179	9.7869	4.5812	1.56137-04 **	39
10	11.667	8.7610	1.1680	.24061	39
15	9.0769	9.3651	-3.9497	5.70007-04 **	39
20	6.6154	9.2127	-9.0730	3.51600-07 **	39
15	18.308	17.206	1.2005	.23564	39
20	17.205	10.964	-1.5919	.11597	39
5	5.9744	5.5559	1.0952	.28001	39
10	7.7105	6.6043	-2.1370	3.70420-02 *	38

Note: * = Sig. at .05 level
** = Sig. at .01 level

TABLE 2

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR ARCHITECTURAL DRAFTING

RCH DRAFTING-SEC					
ANS	MEAN	DEV	T	Q	NMBR
20	32.448	19.692	3.4043	2.33669-03 **	29
30	27.862	12.250	-.93988	.64220	29
35	18.586	11.475	-7.7028	2.84970-06 **	29
10	10.897	9.2441	.52229	.61147	29
5	4.6897	6.2169	-.26882	.78599	29

CH DRAFTING-POST SEC					
ANS	MEAN	DEV	T	Q	NMBR
20	25.357	12.010	1.6690	.11605	14
30	24.714	13.041	-1.5166	.15053	14
35	24.143	6.8484	-5.9318	1.42706-04 **	14
10	14.357	12.220	1.3341	.20300	14
5	6.2143	4.8861	.92988	.62774	14

Note: * Sig. at .05 level
** Sig. at .01 level

TABLE 3

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR AUTO BODY REPAIR

AUTO BODY REPAIR-SEC

ANS	MEAN	DEV	T	O	NMBR
15	14.400	7.1972	-.18641	.85442	5
25	27.600	5.5946	1.0392	.35896	5
25	16.000	8.2158	-2.4495	7.02774-02 **	5
7	6.6000	4.7749	-.18732	.85374	5
10	11.600	4.7749	.74927	.50103	5
10	8.8000	6.6858	-.40134	.70696	5
5	4.6000	3.6469	-.24526	.81152	5
3	17.600	12.700	2.5705	6.18593-02 **	5

AUTO BODY REPAIR-POST SEC

ANS	MEAN	DEV	T	O	NMBR
15	10.067	3.0111	-6.3454	7.53834-05 **	15
25	22.133	9.8913	-1.1225	.28038	15
25	22.600	6.6954	-1.3883	.18431	15
7	6.8000	1.9712	-.39295	.70138	15
10	13.267	4.9203	2.5713	2.11285-02 *	15
10	9.9333	4.9493	-5.21692-02	.95807	15
5	3.0667	2.7894	-2.6843	1.70122-02 **	15
3	7.4667	4.1034	4.2158	1.13548-03 **	15

Note: * Sig. at .05 level
** Sig. at .01 level

TABLE 4

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR AUTO MECHANIC

AUTO MECHANICS-SEC

ANS	MEAN	DEV	T	Q	NMBR
5	10.885	7.9450	5.3410	2.78674-05 **	52
15	17.615	6.3560	2.9673	4.77382-03 **	52
10	8.7170	3.2604	-2.8649	6.09924-03 **	53
10	12.585	6.1282	3.0708	3.68175-03 **	53
10	6.2745	4.1669	-6.3849	5.09671-06 **	51
15	13.451	8.1666	-1.3546	.17848	51
10	10.788	5.0423	1.1276	.26388	52
10	9.0192	4.2817	-1.6518	.10091	52
10	5.4038	5.3211	-9.9796	7.83191-05 **	52
5	4.6538	3.6239	-6.8880	.50103	52

AUTO MECHANICS-POST SEC

ANS	MEAN	DEV	T	Q	NMBR
5	5.9048	3.2968	1.7786	7.91868-02	42
15	16.860	15.916	.76653	.54612	43
10	8.5500	6.2550	-1.4661	.14709	40
10	12.190	8.2440	1.7220	8.89526-02	42
10	6.6000	4.9861	-4.3127	2.60529-04 **	40
15	6.2439	6.4606	-8.6782	4.54136-07 **	41
10	17.136	15.906	2.9760	4.96168-03 **	44
10	19.571	16.381	3.7866	7.71409-04 **	42
10	7.0000	4.2426	-4.3589	2.48829-04 **	38
5	7.2683	6.7008	2.1675	3.41102-02 *	41

Note: * = Sig. at .05 level
** = Sig. at .01 level

TABLE 5

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR CARPENTRY

CARPENTRY-SEC

ANS	MEAN	DEV	T	D	NMBR
5	6.7619	6.1120	1.8682	6.56076-02	42
5	5.0000	5.8393	0.00000	1.0000	42
5	5.6667	3.3689	1.2825	.20432	42
9	11.881	4.0737	4.5832	1.44485-04**	42
10	13.571	5.8315	3.9690	5.16580-04**	42
2	4.3571	4.5146	3.3837	1.93146-03**	42
13	13.786	5.7192	.89034	.61788	42
5	4.1667	2.8449	-1.8983	6.15226-02	42
15	8.4419	4.9871	-8.6231	4.30751-07**	43
9	5.5714	5.0031	-4.4412	1.91913-04**	42
5	4.5116	5.2887	-.60553	.55497	43
17	9.3111	5.3079	-9.7173	1.38508-07**	45

CARPENTRY-POST SEC

ANS	MEAN	DEV	T	D	NMBR
5	10.417	3.4499	5.4390	3.80245-04**	12
5	5.9167	4.5419	.69914	.50485	12
5	3.1667	3.5119	-1.8084	9.52040-02	12
9	9.2500	3.7929	.22833	.81773	12
10	12.583	6.3883	1.4008	.18665	12
2	3.5833	2.5391	2.1602	5.15546-02*	12
13	14.750	4.8077	1.2609	.23206	12
5	5.7500	4.1806	.62146	.55273	12
15	11.167	3.9734	-3.3420	6.60715-03**	12
9	5.7500	4.9566	-2.2714	4.23304-02*	12
5	6.0833	4.6409	.80863	.55906	12
17	9.9167	4.3786	-5.6036	3.18842-04**	12

Note: *Sig. at .05 level
**Sig. at .01 level

TABLE 6

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR COSMETOLOGY

COSMETOLOGY-SEC

ANS	MEAN	DEV	T	Q		NHBR
8	5.2353	5.2978	-2.1517	4.48022-02	*	17
7	7.2353	2.9268	.33147	.74300		17
9	12.235	3.0929	4.3129	7.81280-04	**	17
4	7.2353	2.6346	5.0632	2.52310-04	**	17
9	5.8824	3.3705	-3.8138	1.81875-03	**	17
7	17.471	3.2476	4.4129	6.65506-04		17
21	17.118	5.3605	-2.9862	8.57170-03	**	17
15	13.118	4.0909	-1.8972	7.30907-02	**	17
3	2.8824	2.2606	-.21458	.82695		17
7	4.3529	2.3964	-4.5544	5.33217-04	**	17
2	2.2941	2.5437	.47673	.64433		17
3	5.1176	2.9343	.16531	.86497		17
5	6.2941	4.3984	1.2131	.24137		17

COSMETOLOGY-POST SEC

ANS	MEAN	DEV	T	Q		NHBR
8	2.9355	1.7689	-15.941	1.49306-08	**	31
7	7.2581	4.1870	.34317	.73333		31
9	12.548	3.3945	5.8202	2.57303-05	**	31
4	8.8065	4.0614	6.5892	8.87837-06	**	31
9	6.8710	3.8448	-3.0831	4.56266-03	**	31
7	11.581	3.2329	7.8889	1.98335-06	**	31
21	13.323	9.5965	-4.4543	2.56500-04	**	31
15	12.194	3.8507	-4.0579	5.57869-04	**	31
3	3.2069	3.4057	.32715	.74462		29
7	3.0968	1.9724	-11.018	1.55666-07	**	31
2	1.5882	1.3257	-1.2807	.21664		17
3	1.7000	1.4420	-4.9379	1.11452-04	**	30
5	4.2581	3.5305	-1.1701	.24993		31

Note: * Sig. at .05 level
** Sig. at .01 level

TABLE 7

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR DIESEL ENGINE REPAIR

DIESEL ENGINE REPAIR-POST SEC					
ANS	MEAN	DEV	T	O	NHBR
25	17.100	15.836	-1.5776	.14674	10
15	8.3333	8.2916	-2.4121	4.08953-02 **	9
20	18.333	23.318	-.21442	.82928	9
15	18.889	19.650	.59373	.57413	9
25	34.889	24.111	1.2304	.25277	9

Note: * = Sig. at .05 level
** = Sig. at .01 level

TABLE 8

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR ELECTRONICS COMMUNICATIONS

ELECTRICAL COMMUNICATIONS-SEC

ANS	MEAN	DEV	T	Q		NMB
8	20.364	12.909	3.1764	9.71724-03	**	11
5	7.7273	7.4309	1.2173	.25056	**	11
2	5.6364	4.4558	2.7067	2.11688-02	**	11
9	5.4545	3.5599	-3.3032	7.93513-03	**	11
5	4.2727	2.7961	-.86266	.58731		11
4	5.8182	3.3111	1.8212	9.59758-02		11
4	10.182	5.8621	3.4975	5.86034-03	**	11
12	4.4545	3.5599	-7.0299	1.21437-04	**	11
1	3.0000	3.2474	2.1335	5.40434-02	*	11
19	8.0909	4.8673	-7.4335	9.11443-05	**	11
15	11.182	6.8676	-1.8440	9.23915-02		11
16	12.545	8.2990	-1.3606	.19551		11

ELECTRICAL COMMUNICATIONS-POST

ANS	MEAN	DEV	T	Q		NMBR
8	16.029	20.166	2.3553	2.30463-02	*	35
5	7.4571	5.6430	2.5760	1.38735-02	*	35
2	4.1429	3.1636	4.0072	5.52301-04	**	35
9	6.7714	6.2123	-2.1223	3.88744-02	*	35
5	7.6000	7.1710	2.1450	3.69729-02	*	35
4	6.3714	4.5120	3.1094	4.02049-03	**	35
4	10.543	12.118	3.1943	3.30737-03	**	35
19	7.0571	5.6461	-12.514	4.17003-08	**	35
1	3.0882	3.0488	3.9939	5.82796-04	**	34
19	11.571	13.283	-3.3087	2.54694-03	**	35
15	9.0571	5.8558	-6.0040	1.59145-05	**	35
16	8.9429	9.5207	-4.3852	2.56346-04	**	35

Note: * = Sig. at .05 level
** = Sig. at .01 level

TABLE 9

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR ELECTRONICS INSTALLATION

ELECTRICAL INSTALLATION-SEC

ANS	MEAN	DEV	T	Q		NMBR
10	13.514	7.0183	3.0452	4.53900-03	**	37
5	8.0541	4.3394	4.2810	2.98706-04	**	37
5	11.270	5.1782	7.3656	2.35780-06	**	37
15	3.0000	6.1146	-11.937	4.80455-08	**	37
15	26.702	20.010	4.0093	4.36322-04	**	47
5	1.4865	3.0878	-6.9214	4.07423-06	**	37
10	6.4595	5.8433	-3.6856	1.05441-03	**	37
20	10.189	14.487	-4.1193	4.16277-04	**	37
10	7.4324	4.4381	-3.5191	1.52821-03	**	37
5	6.5135	5.1619	1.7835	7.94432-02		37

ELECTRICAL INSTALLATION-POST S

ANS	MEAN	DEV	T	Q		NMBR
10	9.8182	5.7761	-.10440	.91551		11
5	7.7273	6.4045	1.4123	.18610		11
5	6.5455	4.2747	1.1991	.25742		11
15	14.091	5.3936	-.55902	.59362		11
15	20.455	9.3420	1.9365	7.90666-02		11
5	4.8182	4.3776	-.13775	.88811		11
10	9.0000	4.6260	-.71695	.50443		11
20	15.455	5.6809	-2.6537	2.31603-02	**	11
10	6.2727	3.8753	-3.1899	9.50789-03	**	11
5	2.6364	1.9633	-3.9929	2.82965-03	**	11

Note: * = Sig. at .05 level
** = Sig. at .01 level

TABLE 10

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR INDUSTRIAL ELECTRICIAN

INDUSTRIAL ELECTRICIAN-POST SE					
ANS	MEAN	DEV	T	Q	NMBR
10	18.000	9.5169	2.3776	4.76123-02 *	8
15	20.500	7.3095	2.1282	6.90447-02 *	8
15	18.000	9.0554	.93704	.61728	8
30	17.750	9.8089	-3.5323	9.63252-03 **	8
30	16.375	9.1486	-4.2124	4.33160-03 **	8

Note: * = Sig. at .05 level
 ** = Sig. at .01 level

TABLE 11

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR INDUSTRIAL ELECTRONICS

INDUSTRIAL ELECTRONICS-POST SE

ANS	MEAN	DEV	T	Q		NMBR
16	16.103	14.637	3.80603-02	.96876		29
10	7.6552	6.9605	-1.8141	7.70436-02	*	29
6	10.928	12.367	2.1022	4.22548-02	*	29
8	10.034	6.7901	1.6135	.11427		29
16	11.103	7.7752	-3.3914	2.40317-03	**	29
10	9.8276	7.3924	-.12560	.89645		29
10	10.724	6.9483	.56123	.58552		29
10	6.1034	4.7610	-4.4074	3.03568-04		29
2	4.1429	3.3523	3.3824	2.51596-03	**	28
4	4.6552	4.4982	.78436	.55474		29
4	3.9310	4.5350	-8.18938-02	.93309	**	29
4	2.6207	2.8210	-2.6330	1.30599-02	**	29

Note: * = Sig. at .05 level
 ** = Sig. at .01 level

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR MACHINE DRAFTING

MACHINE DRAFTING-SEC

ANS	MEAN	DEV	T	O		NMBR
15	13.586	8.5795	-.88740	.61385		29
7	14.207	5.4732	7.0910	5.57114-06	**	29
9	24.241	12.702	6.4619	1.20227-05	**	29
10	7.4828	5.8286	-2.3257	2.59612-02	*	29
10	6.0690	5.7751	-3.6656	1.33547-03	**	29
10	12.000	5.9940	1.7968	7.97757-02		29
16	7.1724	4.2179	-11.271	1.68750-07	**	29
11	8.8621	5.1250	-2.2464	3.09082-02	*	29
12	5.4138	5.4610	-6.4947	1.15248-05	**	29

MACHINE DRAFTING-POST SEC

ANS	MEAN	DEV	T	O		NMBR
15	10.235	5.3095	-3.7000	2.22775-03		17
7	12.118	5.7758	3.6533	2.42401-03	**	17
9	20.529	11.775	4.0373	1.23444-03	**	17
10	8.0000	6.8648	-1.2012	.24594		17
10	7.9412	5.9840	-1.4186	.17250		17
10	7.4118	3.5542	-3.0025	8.30107-03	**	17
16	12.176	6.4152	-2.4574	2.44841-02	*	17
11	7.0588	5.1414	-3.1606	6.10371-03	**	17
12	7.8235	5.2230	-3.2970	4.69982-03	**	17

Note: * = Sig. at .05 level
** = Sig. at .01 level

TABLE 13

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR MACHINE TRADES

MACHINE TRADES-SEC

ANS	MEAN	DEV	T	O		NMBR
12	16.732	8.9163	3.3980	1.89331-03	**	41
3	7.8049	3.6416	8.4486	5.72301-07	**	41
17	23.780	10.790	4.0237	4.67554-04	**	41
17	15.634	7.4120	-1.1799	.24348		41
5	9.4390	4.9094	5.7896	1.73500-05	**	41
4	.31707	1.3498	-17.471	2.58067-09	**	41
5	3.1707	3.2241	-3.6329	1.10629-03	**	41
17	2.6098	3.8333	-24.038	4.59045-10	**	41
5	4.5366	3.7222	-.79719	.56427		41
5	1.2927	3.2113	-7.3922	1.85949-06	**	41
5	2.2927	4.3488	-3.9862	5.06865-04	**	41
5	7.6595	5.7472	2.9619	5.27764-03	**	41

MACHINE TRADES-POST SEC

ANS	MEAN	DEV	T	O		NMBR
12	10.600	5.1559	-1.3577	.18442		25
3	5.6000	3.7193	3.4953	2.17408-03	**	25
17	22.160	8.1429	3.1684	4.34177-03	**	25
17	21.375	8.2347	2.6028	1.51831-02	**	24
5	8.5200	4.9423	3.5611	1.89711-03	**	25
4	1.7600	2.6814	-4.1769	5.62236-04	**	25
5	2.2800	2.7160	-5.0074	1.31330-04	**	25
17	6.9200	5.0077	-10.065	6.22102-07	**	25
5	5.6800	3.3257	1.0224	.31790		25
5	2.2000	3.1358	-4.4645	3.31502-04	**	25
5	4.5000	3.2303	-.75829	.53785		24
5	6.4000	4.1733	1.6773	.10298		25

Note: * = Sig. at .05 level
** = Sig. at .01 level

TABLE 14

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR MASONRY

MASONRY-SEC

ANS	MEAN	DEV	T	Q		NMBR
15	11.902	6.2041	-3.1970	3.02675-03	**	41
12	6.4878	5.7755	-6.1112	1.05338-05	**	41
9	8.4878	4.9504	-.66251	.51834		41
12	15.317	9.2532	2.2954	2.54721-02	*	41
35	34.756	17.228	-9.06535-02	.92551		41
7	11.195	7.3865	3.6366	1.09711-03	**	41
10	9.0732	3.5524	-1.6706	9.88894-02		41

MASONRY-POST SEC

ANS	MEAN	DEV	T	Q		NMBR
15	3.3125	2.0565	-22.733	1.35805-07	**	16
12	6.5000	3.4833	-6.3159	6.40289-05	**	16
9	6.2500	4.1231	-2.6679	1.67693-02	*	16
12	13.750	6.7971	1.0299	.32055		16
35	55.250	14.920	5.4290	1.78530-04	**	16
7	6.1250	3.2016	-1.0932	.29172		16
10	6.3125	4.2851	-3.4421	3.83879-03	**	16

Note: * = Sig. at .05 level
** = Sig. at .01 level

TABLE 15

AVERAGE INSTRUCTIONAL TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR PRINTING

PRINTING-SEC					
ANS	MEAN	DEV	T	Q	NMBR
12	8.7500	8.5391	-.76120	.50441	4
23	7.5000	6.4550	-4.8025	1.54625-02	4
15	20.000	0.00000	0.00000	1.00000	4
15	20.000	9.1287	1.0954	.35448	4
24	23.750	2.5000	-.20000	.84703	4
11	16.250	11.087	.94707	.58443	4

PRINTING-POST SEC					
ANS	MEAN	DEV	T	Q	NMBR
12	6.7500	6.3415	-2.3416	5.02227-02	8
23	9.3750	7.2887	-5.2873	1.52548-03	8
15	8.1250	7.0394	-2.7624	2.71817-02	8
15	27.250	27.655	1.2529	.24976	8
24	33.500	25.818	1.0407	.33398	8
11	10.500	6.6975	-.21115	.83234	8

Note: * Sig. at .05 level
** Sig. at .01 level

TABLE 16

AVERAGE INSTRUCTION TIME JUDGED BY TEACHERS COMPARED TO THE
OCCUPATIONAL STANDARD EMPLOYED IN THE CONSTRUCTION OF THE
NOCTI WRITTEN TESTS FOR WELDING

WELDING-SEC						
ANS	MEAN	DEV	T	Q		NMBR
23	36.619	19.572	4.5095	1.67263-04	**	42
10	10.333	9.3173	.23185	.81262		42
17	18.357	9.3151	.94419	.64710		42
6	.54762	1.3104	-26.965	2.38542-10	**	42
10	5.3095	7.5304	-4.0367	4.46306-04	**	42
10	2.8095	2.3189	-20.095	1.03162-09	**	42
6	1.5476	3.0300	-9.5232	1.94784-07	**	42
6	1.4286	2.2968	-12.899	1.79123-08	**	42
6	7.6905	6.6387	1.6502	.10279		42
6	3.8095	7.1542	-1.9843	5.10849-02	**	42

WELDING-FOSI SEC						
ANS	MEAN	DEV	T	Q		NMBR
23	44.080	18.536	5.6863	4.67253-05	**	25
10	5.8400	2.6876	-7.7392	4.10237-06	**	25
17	15.760	8.6568	-.71620	.51264		25
6	1.6000	4.1130	-5.3489	7.68011-05	**	25
10	5.0800	4.1223	-5.9675	3.16158-05	**	25
10	5.7200	4.5048	-4.7505	2.01229-04	**	25
6	3.5600	4.2434	-2.8750	8.20614-03	**	25
6	3.1600	2.5606	-5.5456	5.72643-05	**	25
6	5.1200	3.2057	-1.3725	.17973		25
6	5.1200	3.2057	-1.3725	.17973		25

Note: * = Sig. at .05 level
** = Sig. at .01 level

SCOPE OF AIR CONDITIONING AND REFRIGERATION EXAMINATION

WRITTEN TEST
TIME: 3 hours

PERCENT
OF TEST

5% Domestic Systems Installation

Measuring temperatures & pressures; methods of heat transfer; principles of the refrigeration cycle; utilization of proper tools; principles of soldering & welding various tubing connections.

10% Domestic Systems Servicing

PS Principles of gauges & thermometers; principles of the compression system; servicing hermetic compressors; construction & operation of relays; motor construction & application.

15% Commercial System Installation

Principles of refrigeration piping; determining load calculations; operation & principles of metering devices, dehydrators & multiple systems; principles & procedures of evacuating a system; oil characteristics; year-round air conditioning.

20% Commercial System Servicing

Methods of leak testing, charging & discharging systems; methods & principles of testing electrical systems; servicing & testing metering devices; methods of defrosting; year-round air conditioning.

PERCENT
OF TEST

15% Residential Air Conditioning and Heating Installation

Comfort standards of heating & cooling; building construction; heat transfer calculations; equipment selection; psychrometrics; air distribution; duct design; National Refrigeration Safety Code.

20% Residential Air Conditioning and Heating Service

Troubleshooting; compressor replacement; maintenance procedures; system balancing; safety procedures; customer relationships.

5% Industrial Refrigeration Installation

PS Building construction; heat gain & loss calculations; equipment selection; blueprint reading; equipment setting; piping techniques; methods of controlling temperature; safety; National Code Requirements.

10% Industrial Refrigeration Service

Controlled area temperatures & conditions; pressure-temperature-humidity relationships; diagnosing procedures for servicing; lubrication systems; modulating unloaders; functioning of relays, starters, contactors & circuit protection.

PERFORMANCE TEST
TIME: 5 hours

33% Domestic Systems Installation and Service

Measure pressures & temperatures with appropriate instruments & gauges; solder & weld various tube connections; service of hermetic compressors; operate, check & repair relays; install, check & operate motors.

33% Commercial System Installation and Servicing

Evacuate & charge a system; install refrigeration piping; test for leaks; test electrical systems.

34% Residential Air Conditioning and Heating

Troubleshoot residential units; maintain and replace compressor; balance a system.

PREPARATION: Personal tools may be used; Handbooks & references will be provided.

KEY:

S = Secondary

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SCOPE OF ARCHITECTURAL DRAFTING EXAMINATION

WRITTEN TEST
TIME: 3 hours

PERCENT
OF TESTPERCENT
OF TEST20% Basic Architectural Data

PS

Tools & equipment; symbols & conventions; calculations for drawings; standards.

30% Planning and Design

SPS

Codes & regulations; spatial & structural organization; aesthetic judgment; practical material selection; site & surrounding relationship; building equipment requirements; traffic and circulation.

35% Materials and Methods of Construction

Concrete; masonry; metals; wood & plastics; thermal & moisture protection; doors & windows; finishes; mechanical; electrical.

10% Structural Systems

SPS

Design; codes; forms; analysis.

5% Administration

SPS

Legal & ethical considerations; professional relationships.

PERFORMANCE TEST
TIME: 5 hours

20% Sections

Prepare sections for various items of construction from front elevations & partial floor plans of residence or commercial buildings.

30% Working Drawings

Prepare working drawings from preliminary sketches of floor plans for the builder to follow.

15% Structural Items

Present on working drawings all required structural items.

15% Electrical Items

Present all electrical items required.

10% Heating

Indicate all necessary heating information.

10% Perspective and Renderings

Make freehand perspective drawings and renderings.

PREPARATION: Bring a set of drawing instruments, drawing pencils (lead holder & leads), slide rule, architect's scales, erasers, erasing shields. If desired, you may bring a lettering guide & Kidders (or other architects and builders) Handbook & Standards.

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SCOPE OF AUTO BODY REPAIR EXAMINATION

WRITTEN TEST
TIME: 3 hours

PERCENT
OF TEST

15% Welding

S

Principles of operation of various types of welding apparatus; types & kinds of welding done in auto body repair; adjustment of welding equipment; types & kinds of nozzles; identification of quality welds; principles of oxygen & acetylene welding; safety precautions.

25% Sheet Metal Repair

SPS

Principles of shrinking, leading & stretching metal; steps & methods in panel repair; characteristics of metals--hardness, plasticity, rigidity, elasticity; forming of metals; identification of tools & equipment in metal repair; nature & function of fillers--plastics, lead; use & operating principles of body repair equipment & machines.

25% Refinishing

PS

Effect of weather conditions on painting & finishing; operating principles & use of painting equipment; use of lacquers & thinners; common defects & how to avoid them; surface preparation for finishing; paints & their characteristics; color combinations & matching of color; safety procedures.

PERFORMANCE TEST
TIME: 6 hours

50% Sheet Metal Repair

Metal bumping & finishing on high & low crown panels; shrinking stretched metal; leading & use of plastics for filling; proper use of body tools & equipment; oxy-acetylene welding of sheet metal; setting up of oxy-acetylene equipment.

30% Refinishing

Select & use spray equipment; apply masking materials, primers, putties & sealer; apply acrylic lacquers & enamels.

PERCENT
OF TEST

7% Glass: Trim and Hardware

SPS

Common fastening devices; construction of doors & panels; types of glass; trim--how to remove & mount.

10% Panel Sections

SPS

Construction of panels; methods of adjustments, removal & replacement; special methods for repair and adjustment.

10% Frame Alignment

S

Principles of operation of machines & equipment; frame straightening procedures & principles; diagnostic procedures.

5% Electrical Circuits

S

Electric Systems on automobiles; troubleshooting the wiring system.

3% Estimating

Appraising collision damage; writing estimates; use of manufacturer's handbooks & reference material.

Safety

Shop safety; proper use of power tools; combustible material storage.

10% Body Construction

Adjust & align doors & window glass; remove & replace glass, trim, hardware & body panels.

10% Electrical

Troubleshoot brakelight system, dome light circuit, headlight circuit; check electrical power systems.

PREPARATION: Handbooks and reference material will be provided; however, candidate may bring his own.

KEY:

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WRITTEN TEST
TIME: 4 hoursPERCENT
OF TEST

- 5% Basic Shop Principles & Practices
- PS Hand tools; fittings & fasteners; interpretation of manuals, charts, diagrams & specifications.
- 15% Engines
- PS Overall engine operation; heads, cylinder block, valves & valve mechanisms, piston & connecting rod assembly, crankshaft & bearings, lubrication systems, oil pump & filter, cooling systems, exhaust systems.
- 10% Emission Systems
- PS Fundamentals of Emission Control; crankcase ventilation; exhaust emission; vapor control systems.
- 15% Engine System Analysis and Repair
- PS Use & Interpretation of engine testing devices, ignition systems, fuel systems, emission systems & engine mechanical systems.
- 10% Suspension, Steering and Braking
- S Suspension; alignment; steering; springs; wheels & tires; braking systems; chassis lubrication.

PERCENT
OF TEST

- 10% Fuel Systems
- S Carburetors; fuel pumps; intake manifolds; induction systems & fuels.
- 10% Electrical
- SPS Diagnosis of electrical circuit malfunctions: starter system, ignition system, charging system--AC-DC, lighting & warning systems, battery and electric power distribution.
- 10% Drive Line and Components
- S Gears, bearings & seals; standard transmissions & clutches; overdrive units; automatic transmissions & control circuits; drive lines and universals; differentials & final drive units.
- 10% Accessories
- Heaters; air conditioning; automatic temperature control; automatic seats; speed controls; automatic windows; windshield wiper & washer systems.
- 5% Shop Management and Control
- S Service diagnosis; job pricing & estimating; repair order writing; service routing & management.

PERFORMANCE TEST
TIME: 6 hours12% Engines

Inspect, repair or replace pistons & connecting rods, valve train, cylinder heads, cylinder block, valve stems & guides, bearings & journals, pistons, cylinders; service valves, valve seats, bearings, pistons, rings, connecting rods & cylinder walls; use of precision gauges and indicators.

4% Basic Automotive Practices

Identify major automobile parts: engine, brakes, front end, fuel, emission, charging, starting systems, air conditioning.

9% Fuel Systems

Inspect, adjust & repair: carburetor circuits, float settings, fuel/air ratio, high & low idle.

8% Electrical

Inspect, adjust & repair: electrical components, electrical malfunctions, ignition timing; test instruments & equipment.

5% Batteries

Inspect & service for condition; test for charge with hydrometer; perform battery capacity test (B.S.T.); charge battery according to specifications.

10% Air Conditioning

Use air conditioning testing gauges & equipment; bleed gauges & identify state of charge; follow manufacturer's charging procedures; test system for leaks.

8% Charging Systems

Diagnosis, repair & service alternators, regulators & components; instruments & equipment; inspect charging system.

8% Emission Systems

Identify the correct emission system for the year in which the automobile was manufactured; diagnosis & test emission system components; inspect emission system for proper installation.

12% Engine Analysis and Repair

Inspect engine & accessories for wear & damage, interpret oscilloscope patterns, detect & correct engine malfunctions by use of proper instruments & equipment.

8% Drive Lines and Components

Determine end-play & backlash with dial indicator; interpret gear tooth patterns; check & adjust automatic transmission, check & adjust hypoid differential.

6% Suspension and Steering

Prepare automobile (on rack) for alignment; measure camber, castor & toe-in; make alignment adjustments; check steering wheel to see that it is centered.

10% Brakes

Inspect & repair cylinder bore & rotor; overhaul piston assembly and/or caliper assembly; torque caliper to spindle & wheel bearings.

PREPARATION: Personal tools may be used. Test equipment, shop manuals & specifications will be provided.

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SCOPE OF CARPENTRY EXAMINATION

WRITTEN TEST
TIME: 3 hoursPERCENT
OF TEST5% Surveying, Layout & Blueprint Reading

S Interpretation of building codes, specifications, & blueprints; determination of property line; types & mounting of batter boards; usage & operation of the builder's level; soils and soil testing; 3-4-5 triangle calculations; determination of depth of excavation.

5% Foundation Work

SPS Interpretation of building codes, specifications, & blueprints; determination of elevation of footings; principles of construction of footing & wall forms; types of materials; strength of concrete; curing concrete; provision for openings in concrete walls; usage of plumb bob in transferring lines.

5% Concrete Walls, Floors & Step Construction

SPS Interpretation of building codes, specifications, & blueprints; methods of placing concrete, reinforcing concrete, screeding, floating, troweling, paring & edging of concrete; principles of layout forms, steps and railings.

9% Floor Framing

PS Interpretation of building codes, specifications, & blueprints; installation of girders & posts, types of floors, types of materials (wood, metal hangers, fasteners); selection, care & usage of hand tools (saw, brace, auger bits, 100 ft. tape hammer).

10% Wall and Ceiling Framing

PS Interpretation of building codes, specifications, & blueprints; fabrication of lintels and corner posts; western and balloon construction; plumbing & bracing; determination of studs, trimmer, lintel, cripple & rough opening sizes; methods of tying walls together; installation & usage of fire block & backing.

5% Estimating

SPS Excavation quantities; concrete, reinforcing steel & forming materials; floor & ceiling joists; wall framing & sheathing materials; roof framing, sheathing & covering materials; outside finish materials (molding, siding); interior finish materials (moldings, coverings, hardware); insulation and acoustical materials.

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PERCENT
OF TEST2% Scaffolding

Principle of construction for double pole scaffold; scaffold with brackets; safety as applied to scaffolding.

13% Roof Framing and Roofing

SPS Interpretation of building codes, specifications, & blueprints; roof terminology & design; rafter layout (common, hip, valley, hip jack, valley jack & cripple); framing square & after tables; usage of radial arm saw, portable electric saw & plumb bob; toe nailing; cutting gable studs; louvers & purpose of ventilation; methods of flashing; types of materials; methods of applying wood shingles, composition shingles & built-up roofing; installation of gutters & drain pipes; safety measures.

5% Stair Construction

SPS Interpretation of building codes, specifications, & blueprints; stair design; layout of stair horses; use of framing square, dividers & portable electric saw; methods of installing finish tread & riser; installation of handrail.

15% Interior Finish

Interpretation of building codes, specifications, & blueprints; application of sheet rock & taping processes, prefinished panels, installation of door jams, doors (swinging, pocket and bi-passing), casing, baseboard & shoe, finish hardware (clothes rods, towel bars, mirrors, bathroom fixtures, railings, access covers); laying finish flooring; usage of butt gauge, lock template, scraper, nail set, abrasive paper, miter saw, router, belt, portable planer & oscillating sander.

5% Cabinetry

Interpretation of building codes, specifications, & blueprints; installation of prebuilt wall & base cabinets, plastic laminate counter top, building cabinets in place; usage of shaper, mortising attachment, router, fasteners, clamps and adhesives.

17% Exterior Finish

Interpretation of building codes, specifications, & blueprints; types of cornices & roof trim; installation of exterior door jams & window frames; setting columns & beams for porch or roof overhangs; application of siding & types of siding; installation of overhead doors, exterior doors & storm doors; application & types of insulation; preparation of surfaces & installation of acoustical tile.

PERFORMANCE TEST
TIME: 6 hours10% Floor Framing

Installation & layout of sills, girders, posts, floor joists; bridging & subfloor.

20% Wall Framing

Plate layout & installation of framing members; fabrication of lintels & corner posts; western & balloon construction; tying walls together.

30% Roof Framing

Layout & installation of rafters from roof plan; mount gable studs; sheath sides & gable ends; use of power equipment.

10% Roofing

Apply shingles; finish to edges on various types of roofs.

30% Exterior Finish

Install cornices, exterior door & door stop; apply courses of siding.

PREPARATION: Personal tools may be used. It is recommended that you bring your own portable power saw.

SCOPE OF COSMETOLOGY EXAMINATION

WRITTEN TEST
TIME: 3 hoursPERCENT
OF TEST

- 8% Care of Hands and Feet
Manicuring; nail repair; artificial nails; reconditioning manicure; hand & arm massage; electric manicure; pedicure.
- 7% Shampoos and Colorless Rinses
SPS Specialized shampoos
- 9% Permanent Waving
Cold wave; corrective wave.
- 21% Hair Styling
- 15% Haircoloring
S Corrective treatments; eyebrows & lash tinting; bleaching.
- 3% Hair Pieces
SPS

PERCENT
OF TEST

- 4% Care of Hair and Scalp
Scalp care; corrective treatments for scalp; hair conditioning treatments.
- 9% Hair Straightening
Hair pressing; wet setting of pressed hair; croquignole marcel on pressed hair; chemical method.
- 7% Hair Shaping
Cutting children's hair.
- 7% Facial Treatments
Packs & masks; correction of simple conditions.
- 2% Removal of Superfluous Hair
SPS
- 3% Professional Makeup
S
- 5% Shop Operation and Management
SPS

PERFORMANCE TEST
TIME: 6 hours

- 15% Manipulative Techniques of Hairstyling
For this part of the test, the top & crown hair of the model will not be styled. Hair may be parted off & fastened with clips. The applicant must demonstrate the proper execution of the skip wave on each side of the head. The sides must correspond. For the remaining hair at the back of the head, applicant must design a styling pattern which will tie the two side panels together in a manner expected of a skilled hairdresser.
- 5% Scalp Treatment
Brushing techniques; application of tonic & ointment; manipulations.
- 15% Haircutting
Complete shaping & styling of the hair in the current trend adapted to model's hair texture & features.
- 20% Hair Styling
Maximum of 12 rollers unless candidate elects chemical hair styling. Sculpture curls (cascade curls & roller techniques); plan & execute a hair style.

5% Shampooing

Prepare model; brush; shampoo & rinse; show evidence of sanitation & sterilization procedures.

10% Permanent Waving

Do a complete cold wave including test curls & neutralizing.

OR

Hair Coloring

Apply tint and/or bleach for a virgin head or retouch.

10% Wigbery

Comb out a preset wig or affix a wiglet to model to convert the original hair style to a more high fashion or evening style.

20% Chemical Hair Straightening

OR

Thermal Curling

PREPARATION: Two live models (1 model for Hair Styling, Permanent Wave & Hair Color; 1 model for Hair Straightening, chemical or thermal). The candidate must supply another model for hair cutting, unless she elects to do one of the above plus hair cutting on the same model. Models should be selected by the candidate on the basis of suitability for demonstrating the candidate's competency in hair styling, using either permanent waving, hair coloring or hair straightening.

Candidate should bring: Haircutting tools, permanent wave rods (appropriate size), chemical straightener or relaxer (preferred brand), hair clips, combs, brushes, rollers, hair piece, wig or wiglet, tints or toner (preferred brand), protective gloves & apron, manicure tools, thermal curling irons (if needed). Towels, shampoo, peroxide, cotton, standard shop equipment will be furnished.

Upon arriving at the examination, the candidate shall submit to the Examiner the published plan of the hair style he/she intends to execute & a photograph of the finished style. However, if the candidate wants to submit an original plan he/she may do so; it must be of professional quality. If the plan is written rather than diagrammed, it must be typed, double-spaced, 1-1/2" margins on 8x11" paper. A photo of the finished style MUST accompany the plan. In any event, the photo shall be no smaller than 5 x 7 and no larger than 8 x 10. Neither the plan nor photo will be returned to the candidate.

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SCOPE OF DIESEL ENGINE REPAIR EXAMINATION

WRITTEN TEST
TIME: 3 hours

PERCENT
OF TEST

25% Fuel Injection Pumps & Nozzle Repair
PS and Adjustment

Principles of operating the basic fuel injection systems of: Robert Bosch, American Bosch (in-line & distributor types), CAV (in-line & distributor types), Simms, GMC, Cummins, Caterpillar, Roosa Master (DC, DB & C Models); principles of operating injection nozzles; Centrifugal and hydraulic governors of the above systems.

15% Hydraulic Systems Troubleshooting & Repair

Basic principles, Pascal's Law, Bernoulli Principle, etc; principles of operating pumps, control valves, pressure, flow, directional & troubleshooting; function of reservoirs & accessories, actuators; principles & operation of basic air devices; principles of operation & testing procedures on cylinders & motors.

20% Electrical Systems Diagnosis & Repair
PS

Basic electrical theory & its application to electricity; principles of DC & AC generator operation & function; principles & function of operating the ignition system; principle & operation of the starting systems; pre-heat systems and accessory systems, knowledge of current diagnosis & repair procedures for all electrical systems.

PERFORMANCE TEST
TIME: 5 hours

10% Fuel Injection Pump & Nozzle Repair
and Adjustment

20% Testing and Calibrating Pump Systems

Testing & calibrating injection nozzles; servicing centrifugal & hydraulic governors.

35% Basic Engine Diagnosis and Repair

Adjustments & minor tune-up on engines; current methods of refinishing valve faces, valve seats, & valve guides; repair of cylinder area; servicing crankshafts; troubleshooting to determine engine problems.

PERCENT
OF TEST

15% Power Train Operation and Repair
PS

Principles of clutch operation & methods of adjustment; standard transmission operation & methods of diagnosis; power shift transmission troubleshooting; ring gear & pinion functions & adjustment; operation of final reduction drives including planetary and bull gear types; principles of PTO power units (mechanical & hydraulic), brake operation (mechanical & hydraulic).

25% Basic Engine Diagnosis and Repair
PS

Principles & functions of troubleshooting, diagnostic methods for determining engine problems & needed repairs; current methods of refinishing valve faces, valve seats & valve guides; proper measurement & methods of repairing or replacing cylinder area; methods of checking clearances & determining need for replacement of crankshaft units; disassembly & assembly procedures to insure proper performance of the completed engine; adjustments & minor tune-up to be performed on all engines after final assembly.

10% Electrical Systems Diagnosis and Repair

Generator & alternator performance tests and repair.

10% Hydraulic Systems Troubleshooting & Repair

Troubleshooting & repair of control valves; operating, testing & repair of actuators; repair of basic air devices.

15% Power Train Operation and Repair

Power shift transmission repair; methods of clutch adjustments; standard transmission repair; hydraulic & mechanical brake repair; service & repair of PTO power units; service to ring gears & pinions.

PREPARATION: Personal tools may be used.

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SCOPE OF ELECTRICAL INSTALLATION EXAMINATION

WRITTEN TEST
TIME: 3 hours

PERCENT
OF TESTPERCENT
OF TEST10% Reading of Working Instructions

PS Interpretation of floor plans, schematics & wiring diagrams; recognition of symbols. Interpretation of specifications & application of the National Electric Code.

5% Utilization of the National Electric Code

PS Responsibility for enforcement; major provisions of concern to the electrician; national & local relationships for the application & modification of code provisions.

15% Principles, Practices & Procedures for Installation of Electric Power for Residential, Commercial & Industrial Structures

Quality & workmanship; wiring practices & procedures (layout, conduit, cable, Bx, single & multiphase, welding procedures).

5% Principles of Electronics Applied to Electrical Installation

PS Static systems; solid state systems (semiconductors); test equipment.

10% Preventive Maintenance & Troubleshooting

PS Code provisions for maintenance; use of instruments & tools; rotating machinery & equipment controls & circuits.

5% Safety Practices and Regulations

PS Work safety practices & standards; safety regulations concerning installation & operation of rotating machinery & equipment; special code regulations concerning light & power circuits & controls.

15% Principles of Operation & Installation of Controls & Rotating Equipment

AC-DC motors-generators; circuit controls; systems (solid state, remote, air-temperature, sound).

20% Basic Principles of Electricity & Magnetism and Their Application in the Trade

Series, parallel & combination circuits (theory & calculations); AC-DC machinery & equipment; power generation & controls; principles of lighting circuits & controls; communication systems & controls (signal, alarm, sound).

10% Trade Calculations

Material requirements; load calculations & wire size.

5% General Trade Information

S Employer-Employee relationship; business-customer relationship; payroll & time calculations.

PERFORMANCE TEST
TIME: 5 hours

10% Layout and Print Reading

Code interpretation; selection of materials & supplies; plan wiring installations according to NEC regulations

30% Installation of Residential, Commercial Wiring

Wiring methods (Bx, Conduit, EMT); signal systems & alarms; lighting-heating-air conditioning wiring.

25% Installation, Testing & Operation of Controls

Distribution systems, domestic-commercial (single and/or multiphase); install and/or mount equipment on various surfaces found in buildings; mount various kinds of starters & switches.

20% Testing & Troubleshooting of Installations

Rotating equipment; signal systems; alarm systems; starters & switches.

5% Safety10% Code Applications

PREPARATION: Personal tools may be used. You may also bring your own reference material or Handbooks.

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SCOPE OF ELECTRONICS COMMUNICATIONS EXAMINATION

WRITTEN TEST
TIME: 3 hoursPERCENT
OF TESTPERCENT
OF TEST8% Basic Electricity

DC CIRCUITS: Series - Characteristics & calculations (voltage drop, total current, power, total resistance, etc.); Parallel - Characteristics & calculations (voltage drop, total current, power, total resistance, etc.); Combinations - Series - parallel (equivalent resistance, voltage drop, total current, power, total resistance, etc.); voltage divider calculations.

5% Measurements, Standards and Tolerances

Calculation of shunts for ammeters; calculation of multiplier resistors for voltmeters; meter sensitivity & loading effects; Ohmmeter circuitry; Oscilloscopes as voltmeters; determination of unknown frequencies with an oscilloscope; observing waveshapes with an oscilloscope.

2% Conductors, Insulators and Semi-conductors

Factors affecting resistance of copper conductors, conductivity of semi-conductor materials; effectiveness of various materials as insulators.

1% Batteries, Source of Voltage

Primary cells (zinc-carbon, alkaline); secondary cells (lead-acid, nickel-cadmium).

19% Vacuum Tube & Solid State Devices

BASIC ASPECTS: static characteristics, dynamic characteristics, biasing, transistor characteristics; other semi-conductor devices.

PERFORMANCE TEST
TIME: 5 hours33% Radio Equipment

Alignment of AM & FM radios; component failures (shorts or opens); repair of low power transmitters.

17% Recording Equipment

Adjust mechanical malfunctions of record changers or tape transports; knowledge of cleaning or drive mechanisms of record changers & tape transports.

PREPARATION: Personal tools may be used; Allied Data Handbook may be consulted.

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9% Amplifiers in Cascade for RF and AF

Coupling methods; decoupling; frequency response; inverse feedback; gain or attenuation (db); voltage vs. power amplifiers; optimum transfer of energy.

5% Other Concepts, Electronics

S Amplitude modulation; frequency modulation; pulse definitions; logic concepts.

4% Inductive Devices

S Transformer operation & calculations (phase, voltage, & current relationships, regulation); radio-frequency inductors (rf, if, powdered iron & air core, single & double-tuned).

4% Alternating Current

Basic concepts (RMS, effective, peak, peak-to-peak values); effect of inductance in an AC circuit; effect of capacitance in an AC circuit.

12% Single Phase Circuits

Series (R,L,C); Parallel (R,L,C); Resonance (series, parallel); R-L & R-C time constants.

15% Electronic Circuits

S Power supplies; vacuum tube amplifiers; Oscillators (including multivibrators); semi-conductor devices.

16% Methods and Procedures

S Trouble identification; methods of correction; methods of maintenance & adjustment.

50% Television Service

Component failures; adjustment of service controls; sound section repairs & adjustments; sweep circuit repairs & adjustments; R-F oscillator tuner adjustments; color receiver field adjustments; trap adjustments (4.5 mh).

SCOPE OF INDUSTRIAL ELECTRICIAN EXAMINATION

WRITTEN TEST
TIME: 3 hours

PERCENT
OF TEST

10% Fundamental Knowledge of Electricity
& Electronics Applied by the
Industrial Electrician

Magnetism: sources, magnets, electromagnets, batteries, conductors, insulators, electric current & electric circuits.

15% Basic Concepts & Application of Direct Current
to the Operation, Testing, Maintenance &
Repair of Electric Power Equipment

Determination of volts, ohms, watts, conductance using various laws & principles applied to industrial electrical work; principles of operation of series & parallel circuits, various types of meters, electric motors & generators (their maintenance, repair & installation); determination of efficiency of various power units.

20% Conduit and Tubing

Bend, shape offset or form conduit, metallic tubing, Bx; thread conduit tubing, cut Bx & cable; join tubing.

20% Connect Distribution System

Single; three-phase; transformers.

20% Installation, Service and Repair of
Fluorescent Light System

Troubleshooting, maintenance, replacement and repair.

PERCENT
OF TEST

15% Basic Concepts & Application of Alternating
Current to the Operation, Testing, Maintenance
and Repair of Electric Power Equipment

PS

RL & RC circuits; series & parallel resonance; inductance-capacitance; transformers; filters.

30% Operating Principles and Concepts of Power
Generation and Distribution

Installation, maintenance & repair; transformers; distribution systems; load calculations and appreciation of National Electric Code.

30% Operating Principles and Concepts of Motors
and Controls

Installation, maintenance, repairs; machine circuits; AC & DC motors; types & operation of controls.

PERFORMANCE TEST
TIME: 5 hours

40% Wiring

Wire magnetic starters, motors, generators, controls & switches; mount starters, boxes & wire according to National Electric Code Standards; make wiring diagrams from given directions; troubleshoot magnetic control devices, motors & generators.

PREPARATION: Personal tools may be used.

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SCOPE OF INDUSTRIAL ELECTRONICS EXAMINATION

WRITTEN TEST
TIME: 3 hours

PERCENT
OF TEST

PERCENT
OF TEST

16% Basic Electronic Fundamentals

Basic physics involving atomic structure, conductor, insulator, semi-conductor, electrical terms & units; fundamentals of magnetism-resistance circuits; measuring devices, circuit analysis; sine wave characteristics; resonance amplifiers, semi-conductor fundamentals.

10% Digital Circuits

PS

Computer definitions, block diagrams; associated circuitry; computer circuitry, fundamentals of switching; number system; Boolean algebra, electronic logic; sequential networks; minimization methods.

6% Network (Passive)

DC circuit analysis, network theories & laws; inductance in series & parallel, impedance in R-L Circuits & R-C Circuits; Resonance R-LC Circuits, Gas Tubes.

8% Electronic Control Devices

PS

Application & use of transistors, thyatrons, transistor circuit configuration, characteristic curves.

16% Amplifiers, Detectors and Active Circuits

Test & analyze power supplies, amplifiers, transistor amplifiers, integrated circuits, transistor oscillators, basic oscillator circuits, R-F amplifiers, modulation & detection, non-sinusoidal waveshapes, relaxation oscillators, wave shaping circuits, industrial timer, industrial rectification & inversion, electronic heating.

10% Components

PS

Capacitance--capacitors in series & parallel, transformers, vacuum tube fundamentals, triode vacuum tubes, tetrodes & pentodes, multigrid & special purpose tubes, integrated circuits, silicon controlled rectifiers, photo electric devices.

10% Use of Instruments

PS

Measuring devices, meter movements, ammeter, ohmmeter, voltmeter, multimeter, cathode ray oscilloscope, sweep generators, marker generators, digital voltmeters, counters.

10% Troubleshooting

Location & correction of malfunctions, replacement of component parts.

2% Electronic Assembly Precautions

Reading of circuit diagrams, computations & assembly relationships.

4% Computer Technology

PS

Programming; calculations; conversion of numbers.

4% Energy Conversion (Servoloops)

Application & use of magnetic amplifiers, Saturable reactor, amplifier, self-excited magnetic amplifiers, motors & generators, control systems & synchros, welders, electronic heating.

4% Transducers

Utilization of strain gauges, resistance thermometers, accelerometers, angle position indicators, anemometers, vacuum gauges, thermocouples.

PERFORMANCE TEST
TIME: 5 hours

30% Use of Measuring Instruments

Meters, bridges, oscilloscopes & signal generators as applied, regulated power supplies, amplifiers, oscillators, logic devices & transmission lines.

25% Measure, Observe and Record

Frequency responses, voltage of circuits; assembly of component parts according to circuit or wiring diagrams, wave form measurements and the application of graphic techniques.

30% Use of Test Equipment

Troubleshoot and measure component parts and circuits commonly used in electronic instruments & industrial electronic circuits; isolation of faulty components using standard & special techniques (especially, those employed with transistor circuits).

15% Program simple problems.

PREPARATION: Candidate must bring his own slide rule. Handbook, manuals & other reference material will be provided.

KEY:

S = Secondary

PS = Postsecondary

SPS = Both Secondary & Postsecondary

SCOPE OF MACHINE DRAFTING EXAMINATION

WRITTEN TEST
TIME: 3 hours

PERCENT
OF TESTPERCENT
OF TEST15% Drafting Instruments, Equipment and Media

SPS

Common uses of drawing instruments; types of scales; characteristics of various media; principles of blueprint technique; materials used; factors affecting good quality; microfilming technique

9% Orthographic Projection & Pictorial Drawings

Principle views; auxiliary view projection; sectional view techniques, types; & terminology; terminology & conventions used in working and assembly drawings; types & characteristics of pictorial drawings; isometric principles.

10% Standard Machined Parts

PS

Types & uses of fasteners; notation used to specify fasteners; classification and uses of washer and keys; terminology used with drawing of fasteners, washers, bearings, etc.; bearings and fits.

10% Gears, Cams and Pulleys

PS

Types, classification & general uses; terminology peculiar to transfer of motion components; depiction and specification; calculations involving speeds and torque.

10% Interpretation of Drawings

S

Alphabet of lines; determination of location of items, item size; knowledge of conventional symbols & abbreviations.

PERFORMANCE TEST
TIME: 5 hours

35% Redrawing a Working Drawing

Follow written instructions concerning size, scaling & reproduction of drawing to produce a drawing of good quality; operate blueprint equipment to secure a good print.

8% Construct from directions, geometric shapes.15% Pictorial Presentation

Producing an accurate isometric drawing of an object described by a three view orthographic projection.

7% Basic Machine Drawing Conventions

Dimensioning techniques; placement of information on drawings; lettering; information included on different types of drawings.

16% Related Mathematical Computations

Computation with degrees & minutes, decimal, fractional & mixed numbers in units of English & metric measurement; geometric figures & constructions; use of trigonometric functions.

11% General Drafting Room Procedures

Types & uses of drawings; identification of different kinds of drawings; use of sketches & reference materials, routing & scaling of drawings.

12% Manufacturing Processes and Practices

Identification of the various processes used for shaping & forming metal; common uses of various Manufacturing techniques (stamping, machining, forging, casting, etc.); characteristics of metals; knowledge of generally used processes for producing standard machined parts; strength of materials calculations.

12% Sectional View Presentation

Identify proper reference perspective of cutting plane line on an orthographic drawing; make a correct representative of the sectioned part with regard to materials involved, correct lines & use of accepted conventions.

30% Developing a Working Drawing

From a perspective of a machined part, make complete & accurate working drawing of the part.

PREPARATION: Bring the following items: set of drawing instruments, leadholder & leads, copy of Machinery's Handbook, drafting tape, if desired, an electric eraser and lettering guide.

KEY:

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SCOPE OF MACHINE TRADES EXAMINATION

WRITTEN TEST

TIME: 3 hours

KEY:

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PERCENT
OF TESTPERCENT
OF TEST12% Bench & Assembly Work; Layout & Inspection

PS

Principles & procedures of layout work; interpretation of blueprints, drawings-sketches; principles of inspection & precision measurement; utilization of precision tools & measuring instruments; determination of tolerances, specifications from drawings for proper sequence of operations-treatment of materials; hand tool, assembly & bench operations & utilization of proper tools.

3% Machine Sawing, Filing & Multiple Parts Processing

Principles of operations; special functions (filing, internal & external); cutting tools, blades (friction cutting); selection of blades, file chains, etc.; determination of feeds & speeds.

17% Milling Processes and Machines

S

Types, kinds & capacities of machines; principles of operation (down & climb milling); accessories & special equipment (vert heads, dividing-heads, turntables, application & principles of operation); principles & methods of clamping regular & odd shapes; types, sizes & selection of milling tools; calculation of feeds & speeds for various materials; principles of mechanical or optical contour milling; determination of milling finishes from blueprints & specifications.

5% Drilling, Tapping, Lapping--Machines and Attachments

PS

Sizes & capacities of machines & attachments; single spindle & multiple spindle production operations; principles of precision finishing, reaming, lapping; determination of: tolerances & internal finishes, speeds & feeds, sizes & kinds of drilling & tapping tools; principles & methods of clamping work.

4% Electrical Discharge Machining

Principles of operation of electronic machining; operation & adjustment of controls; determination of limits & tolerances from blueprints and specifications; accuracy; tooling; size.

5% Application of Science

Theory & underlying principles of mechanical advantage; effect of heat & friction; elements of electricity, magnetism, pneumatic & hydraulic power; elements of chemistry (commonly applied to the occupation).

PERFORMANCE TEST
TIME: 5 hours15% Bench & Assembly, Layout & Inspection

Layout of work, including center, reference, contour & dimension lines & surface preparation; use common hand & measuring tools, surface plate, vise & other holding or clamping devices, precision tools & gauges; file, cut, ream, thread, fit, polish & lap according to job instructions; test & inspect with precision inspection tools, precision blocks, gauges, indicators & hardness testers.

10% Drilling, Tapping, Lapping - Machines and Attachments

Set up work-vise, parallels, straps & bolts, jigs and/or combination of accessories; drill, ream, counterbore, countersink, lap & tap, grind drills.

10% Electronic Control Operation

Set up tools in proper sequence; adjust machine for feed & speed; mount tape & make a trial run; make a tape through numerical operation

OR

Material Treatment and Testing

Hardening, tempering; annealing, normalizing, packhardening, carburizing, testing for hardness.

PREPARATION: Personal tools (micrometers & scales) may be used. Safety glasses are required & candidates may bring their own.

17% Turning Processes and Machines

S

Types & kinds of machines (engine lathes, turret lathes, automatic machines); speeds & feeds (adjustments & calculations); clamping devices (mechanical, pneumatic chucks, collets, turn & face plates); calculations for tapers, angles, thread turning; accessories (taper attachments, steady & follower rest); tools & instruments for single or multiple operation; methods of internal & external turning (single edge, box tools); production of single or multiple pieces; principles of turret & automatic turning.

17% Grinding & Precision Finishing - Processes and Machines

Types & kinds of machines & equipment; principles of: operations (form & crush grinding), clamping methods, tool & cutter grinding; identification & selection of abrasive wheels; kinds & types of finishes.

5% Materials Treatment, Identification & Testing

SPS

Characteristics of materials commonly used in the trades (ferrous-nonferrous materials, machining characteristics); identification of sizes, specifications & grades of materials; heat treatment methods (hardening, tempering, annealing, carburizing, surface & spot hardening); special heat treating methods (induction-atmosphere control); hardness testing methods & instruments; cooling methods (water, oil, air).

5% Electrically Controlled Machine Processes (Numerical Control)

Principle of operation; accessories; steps & procedures in planning the tape; sequences in tool setup; cutting feeds & speeds.

5% Shaping and Planing Processes

PS

Principles of operation (shaper, planer); application (advantages & disadvantages); methods of clamping regular & irregular shapes; tools & accessories needed.

5% Trade Computations

PS

Use of reference tables, handbooks & charts as they pertain to calculations; use of formulas characteristic of the occupation; calculations applicable to the work of the occupation.

20% Grinding and Precision Finishing

Surface grinding; slot or shoulder grinding; set up work (magnetic chuck, vise, sine plate, magnetic accessories & other holding devices); select, true & dress abrasive wheels; plain external & internal grinding, taper grinding.

20% Turning and Processing

Set up & operate engine & bench lathes; mount work, chucks, between center, collets, face plates; all basic external & internal turning operations; taper turning; drill, ream, tap, bore & recess operations; sharpen all cutting tools.

20% Milling Processes and Machines

Set up & adjust proper feeds & speeds; set up & operate the dividing head & rotary table-setup for simple & compound indexing; set up: vice & other devices for holding regular & irregular shapes; various milling operations (slotting angle milling & milling); climb milling.

5% Shaping

Set up work & tools--plain surfaces, angular surfaces, contour shapes, slotting & serrating, cutting steps.

SCOPE OF MASONRY EXAMINATION:

WRITTEN TEST
TIME: 2 hours

PERCENT
OF TEST15% Trade Tools

Nomenclature; use & selection of tools; care & maintenance of tools.

12% Terminology

Architectural terms; construction equipment; masonry symbols.

9% Estimating Procedures

S

Brick-work; mortar; concrete; cement-aggregate ratios.

12% Layout Procedures

PS

Bonds & patterns: story pole, fireplace, steps & arches, building foundations.

PERCENT
OF TEST35% Masonry Practices

S

Brick; stone; concrete; tile; plaster & stucco; brick veneer & combined masonry; fireplace and chimney; jointing.

7% Safety

PS

Use of tools & equipment; eye protection; acid & other caustic materials.

10% Materials of the Trade

S

Masonry units; cementing materials; ties & connectors; aggregates; reinforced concrete.

PERFORMANCE TEST
TIME: 3 hours

20% Layout Procedures

Layout the bond; meeting length & width dimensions; meeting height dimension correctly; providing for a straight wall; construction of leads.

40% Work Practices

Skill with trowel, hammer, cutting chisel, level & jointer; lack of waste motion; efficient location & use of materials.

30% Quality of Completed Work

Uniformity of joints; plumb; level; straight; square; accuracy in meeting dimensions; general overall appearance.

10% Observation of Safe Practices

PREPARATION: Personal hand tools will be required

KEY:

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SCOPE OF THE PRINTING EXAMINATIONWRITTEN TEST
TIME: 3 hoursPERCENT
OF TEST12% Design

- S Elements of good design; preparation of copy, selection of method of composition, imposition, layouts, page imposition, work & turn.

23% Composition

Advantages & disadvantages of hot & cold type of composition; familiarity with operation of vari-typer, photo-typewriter, headliner, foto setter, etc.

15% Photo-Preparatory

- S Camera determination of line & halftone copy for various types of jobs; different types of films, chemicals & their use.

PERCENT
OF TEST15% Image-Carriers

- SPS Knowledge of common stripping practice; use of tools & equipment of the trade (plate-making--presensitized offset plates; use, advantages & disadvantages), step & repeat plate-making; other types of offset plates & masters.

24% Image Transfer

- SPS Make ready practices, including positioning, preparing the packing, mixing inks & additives & preparation of chemicals; principles of operation of letterpress and lithography; problems involving all kinds of forms, maintenance of rollers, use of drying & offset devices, scoring & offsetting.

11% Finishing

- SPS Familiarity with operations involving bindery work, folding, stitching, trimming, padding, punching; also types of bindings & other finishing operations.

PERFORMANCE TEST
TIME: 5 hours15% Design

Interpret copy & analyze instruction making thumbnail sketches & layouts; use of printers point system, type specimen books, rules & scales; select appropriate type faces, layout page imposition using a dummy.

25% Composition

Use of adhesives, rules & scales, pen & ink ruling, T-Square, triangle, paste-up preparation of copy for offset reproduction; make up that includes cuts, rules, borders, crop marks, proofreading, treatment of corrections.

10% Finishing

Basic bindery operation: cut stock, fold, stitch, trim, pad, punch & operate other bindery equipment.

15% Photo-Preparatory

Use of films, chemicals & supplies; photographic techniques for contact prints, reductions, enlargements; camera work involving line copy (same copy, enlargement, reduction).

10% Image Carriers

Basic technique of stripping, use of tapes, T-Square, triangles, scribes, knives, straight edges, line-up tables, line up golden rod for margins, centers, gripper margin, etc.

25% Image Transfer

Know offset and/or letterpresses: adjust feeder controls & press pressures, position image, control ink during press run, run press.

PREPARATION: Materials, tools & equipment will be supplied.
You may bring your own material or tools.

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SCOPE OF WELDING EXAMINATION

Appendix-I (continued)

WRITTEN TEST
TIME: 3 hours

PERCENT OF TEST

23% Arc Welding

Basic knowledge of all arc welding processes & material composition; electrodes & gases, electricity applicable to welding.

10% Brazing

S Heating methods; brazing alloys; use of torch on various metals; gas cutting.

17% Oxy-Acetylene

SPS Complete set-up; safety; use of oxy-acetylene on various metals.

6% Resistance Welding

Different resistance processes; basic principle of resistance processes; process control.

10% Joint Design

Working knowledge of basic joints; why a given design is used.

PERCENT OF TEST

10% Welding Symbols

Recognition; application & terminology.

6% Procedure Qualifications

Per section #9, ASME Boiler and Pressure Vessel Codes.

6% Welders Qualifications

Per section #9, ASME Boiler & Pressure Vessel Codes.

6% Weld Inspection and Defects

SPS Working knowledge of possible defects; cause & prevention of defects.

6% Other Welding Processes

PS Basic principle of ultrasonic, electron beam, thermit, solid state & laser welding; safety applicable to above processes.

PERFORMANCE TEST
TIME: 5 hours

72% Shielded Metal Arc Welding

Set-up of material to be welded; current & rod selection; use of test equipment & grinding equipment; welds in the 3G, 2F, 3F & 4F positions.

14% Oxy-Acetylene Brazing

Set-up equipment; preparation of material for brazing; correct tip, flux & filler rod selection; brazing of dissimilar metals.

14% Oxy-Acetylene Welding

Set-up of materials to be welded; adjustment of equipment & torch; testing of completed welds.

PREPARATION: Personal tools may be used. Appropriate work clothes & safety equipment are to be furnished by the candidate: shoes, welding gloves & apron, welding hood & brazing goggles.

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tal Protection Agency to publish, and from time to time revise a list of categories of sources which shall, at the minimum, include those listed in section 306(b) (1) (A). As soon as practicable, but in no case more than one year after the inclusion of a category of sources in such list, the Administrator is required to propose and publish regulations establishing Federal standards of performance for new sources within such categories. The original list of 27 source categories was published January 16, 1973 (38 FR 1624). Standards of performance have been promulgated for all 27 source categories.

The Administrator, after evaluating available information, has determined that photographic processing is an additional category of point sources which meets the above requirements. Evaluation of other point source categories is in progress, and the list will be supplemented from time to time as the Administrator deems appropriate. Accordingly, notice is given that the Administrator, pursuant to section 306(b) (1) (A) of the Act amends the list of categories of sources as follows:

LIST OF CATEGORIES OF SOURCES

30. Photographic.

Effluent limitations guidelines for existing sources appear elsewhere in this issue of the FEDERAL REGISTER.

Dated: July 7, 1976.

JOHN QUARLES,
Acting Administrator.

[FR Doc 76-20341 Filed 7-13-76; 8:45 am]

EQUAL EMPLOYMENT OPPORTUNITY COORDINATING COUNCIL

EMPLOYEE SELECTION PROCEDURES

Uniform Guidelines

The Equal Employment Opportunity Coordinating Council, which is composed of the Department of Labor, the Equal Employment Opportunity Commission, the Civil Rights Commission, the Civil Service Commission and the Department of Justice is charged by law (See 715 of the Civil Rights Act of 1964, as amended, (42 U.S.C. 2000e-14)) to eliminate inconsistency among the operations of the agencies and departments responsible for enforcement of Federal equal employment opportunity law. Pursuant to that mandate, the Coordinating Council began work on proposed uniform guidelines on employee selection procedures early in 1973. A proposed draft of August 23, 1973 was circulated for comment pursuant to the procedures contained in OMB circular A-85. Later drafts also received wide circulation and have been the subject of written and oral comments.

Based upon these comments, the case law, and the American Psychological Association's Standards for Educational and Psychological Tests (1974), the Staff Committee of the Council, working pursuant to decisions made by the Council

at its November, 1974, meeting undertook a redraft of the proposed uniform guidelines.

A draft "Staff Committee Proposal, Sept. 24, 1975," for Uniform Guidelines on Employee Selection Procedures was agreed upon by the designated representatives on the Staff Committee of the four agencies having operational responsibility—the Department of Labor, the Equal Employment Opportunity Commission, the Civil Service Commission, and the Department of Justice—for purposes of Council consideration, and for circularization for analysis and comment.

A majority of the Council believed that the Staff Committee Proposal, Sept. 24, 1975, should be widely circulated for comment, as a step toward achievement of the goal of Uniform Guidelines on Employee Selection Standards.

The Equal Employment Opportunity Commission reviewed the Staff Committee Proposal, and determined that it did not represent the position of that agency, and for that reason opposed circulating the Staff Committee Proposal for prepublication comment pursuant to the A-85 procedure.

The Staff Committee Proposal, September 24, 1975 was accordingly circulated for prepublication comment pursuant to the A-85 procedure. Substantial additional comments were received, and modifications of the proposal were made.

A majority of the Coordinating Council believes that the proposed guidelines, as set forth below, should be published for comment, as a step toward achievement of the goal of Uniform Guidelines on Employee Selection Standards; and this publication is made accordingly.

These proposed guidelines were prepared prior to the Supreme Court's decision in *Washington v. Davis*, S. Ct. No. 74-1497, June 7, 1976, 44 U.S.L.W. 4789. Accordingly, in addition to comments on the draft in general, comments are solicited on the effect, if any, of that decision on the issues to which the testing Guidelines are addressed.

The Equal Employment Opportunity Commission has reviewed the draft, and has determined that it does not represent the position of that agency; and for that reason has opposed publication for comment. It does, however, continue to adhere to the view that a uniform Federal position on employee selection procedures is a desirable objective.

Because one of the roles of the Civil Rights Commission is to analyze critically the efforts of Federal agencies in the enforcement of civil rights law, the Coordinating Council did not seek or receive the concurrence of that agency in the decision to circulate and publish the proposed guidelines.

Any comments on the draft should be submitted, in quintuplicate, within forty-five (45) days of this date to:

Harold R. Tyler, Jr., Chairman, EEO Coordinating Council, U.S. Department of Justice, Washington, D.C. 20530.

Pursuant to the authority of secs. 201, 202, 203(a), 205, 206(a), 301, 303(a), 303(b), and 403(b) of Executive Order 11246, as amended, 30 FR 12319, 32 FR 14303, § 60-1.2 of Part 60-1 of 41 CFR Chapter 60, and Section 715 of the Civil Rights Act of 1964, as amended, (42 U.S.C. 2000e-14), notice is hereby given that the Department of Labor proposes to rescind present 41 CFR Part 60-3 and substitute a new Part 60-3, as set forth below.

Notice is hereby given that under authority of Section 3301, 3302, and 7301 of Title V, and Section 4763(b) of Title 42 U.S.C., and Executive Order 10577, 3 CFR 1954-1954 comp., p. 218, and Executive Order 11478, 3 CFR 1969, comp., p. 133, and Sec. 715 of the Civil Rights Act of 1964, as amended, (43 U.S.C. 2000e-14), Civil Service Commission proposes to issue federal personnel manual supplement appendices, as set forth below, to provide guidance and furtherance of the principles of Supplement 271-1 (development of qualification standards), 271-2 (test and other applicant appraisal procedures) 335-1 (evaluation of employees for promotion and internal placement) and 990-1 (Book 3), Part 990 subpart F (administration of standards for a merit system of personnel administration). Test standards are located at part 70 Title V of the Code of Federal Regulations (1) of the Federal Personnel Manual, insuring that examining, testing standards and employment practices are not affected by discrimination on the basis of race, color, religion, sex and national origin.

The Commission is not required to publish these proposed guidelines in advance of their effective date. However, in the interest of obtaining views from as many sources as possible, interested persons may submit written comments, objections, and suggestions as set forth above.

HAROLD R. TYLER, JR.,
Deputy Attorney General and
Chairman, Equal Employment
Opportunity Coordinating
Council.

Dated: July 9, 1976.

UNIFORM GUIDELINES ON EMPLOYEE SELECTION PROCEDURES

PART I—GENERAL PRINCIPLES

- Sec. 1. Statement of purpose.
2. Scope.
3. Relationship between use of selection procedure and discrimination.
4. Information on impact.
5. General standards for validity studies.
6. Cooperative validity studies and use of other validity studies.
7. No assumption of validity.
8. Employment agencies and employment services.
9. Disparate treatment.
10. Retesting.
11. Affirmative Action.

PART II—TECHNICAL STANDARDS

12. Technical standards for validity studies.

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PART III—13. DOCUMENTATION OF VALIDITY EVIDENCE

PART IV—14. DEFINITIONS

PART I

GENERAL PRINCIPLES

§ 1 Statement of purpose.

a. These Uniform Guidelines on Employee Selection Procedures have been developed under the auspices of the Equal Employment Opportunity Coordinating Council, established by Section 715 of Title VII of the Civil Rights Act of 1964, as amended.

b. These guidelines are intended to be a set of principles which will assist employers, labor organizations, employment agencies, and licensing and certification boards in complying with equal employment opportunity requirements of Federal law with respect to race, color, religion, sex and national origin. They are designed to provide a framework for determining the proper use of tests and other selection procedures consistent with Federal law. These guidelines do not call for a user to conduct validity studies of selection procedures where no adverse impact results. However, all users are encouraged to use selection procedures which are valid, especially users operating under merit principles. Nothing in these guidelines is intended or should be interpreted as discouraging the use of procedures which have been properly validated in accordance with these guidelines for the purpose of determining qualifications or selecting on the basis of relative qualifications. Nothing in these guidelines is intended to apply to persons not subject to the requirements of Title VII, Executive Order 11246, or other equal employment opportunity requirements of Federal law. These guidelines are not intended to apply to any responsibilities an employer, employment agency or labor organization may have under the Age Discrimination in Employment Act of 1967 not to discriminate on the basis of age.

§ 2 Scope.

a. These guidelines will be applied by the Department of Labor to contractors and subcontractors subject to Executive Order 11246 as amended by Executive Order 11375 (hereinafter "Executive Order 11246"); and by the Civil Service Commission to federal agencies subject to Sec. 717 of the Civil Rights Act of 1964, as amended by the Equal Employment Opportunity Act of 1972 (hereinafter "the Civil Rights Act of 1964") and to its responsibilities toward state and local governments under Section 203(b)(1) of the Intergovernmental Personnel Act; and by the Department of Justice in exercising its responsibilities under Federal law.

b. These guidelines apply to selection procedures which are used as a basis for any employment decision. Employment decisions include but are not limited to hire, additional compensation or promotion, demotion, membership (for example in a labor organization), referral, retention, licensing and certification, to the extent that licensing and certification may be covered by Federal equal employment opportunity law. Employment decisions may also include transfer, job or work assignments, or training if they are used as a basis for additional compensation or any of the decisions listed in the preceding sentence. If the procedures are not used as a basis for additional compensation or any of the decisions listed in the preceding sentence, however, they are not considered selection procedures for purposes of these guidelines.

c. These guidelines do not apply to the use of a bona fide seniority system within the meaning of Title VII of the Civil Rights Act of 1964, as amended, as defined by Federal appellate court decisions, for promotion, ad-

ditional compensation, retention, discharge, lay off, transfer, job or work assignments, or training. These guidelines do not call for the validation of such a seniority system used as a basis for such employment decisions, and the use of such a seniority system as a basis for such employment decisions is consistent with these guidelines.

d. These guidelines do not apply to the entire range of Federal equal employment opportunity law, but only to selection procedures which are used as a basis for making employment decisions. For example, the use of recruiting procedures designed to attract racial, ethnic or sex groups which were previously denied employment opportunities or which are presently underutilized may be necessary to bring an employer into compliance with Federal law, and is frequently an essential element to any effective affirmative action program; but the subject of recruitment practices is not addressed by these guidelines because that subject concerns procedures other than selection procedures.

§ 3 Relationship between use of selection procedures and discrimination.

a. The use of any selection procedure which has an adverse impact on the members of any racial, ethnic or sex group with respect to hiring, promotion, transfer or other employment or membership opportunities, will be considered to be discriminatory and inconsistent with these guidelines, unless the procedure is validated in accordance with the principles contained in these guidelines or unless use of the procedure is warranted under § 3b.

b. There are circumstances in which it is not feasible or not appropriate to utilize the validation techniques contemplated by these guidelines. In such circumstances, the user should utilize selection procedures which are as job related as possible and which will minimize or eliminate adverse impact. (1) When an unstandardized, informal or un-scored selection procedure which has an adverse impact is utilized, the user should seek insofar as possible to eliminate the adverse impact, or, if feasible, to modify the procedure to one which is a formal, scored or quantified measure or combination of measures and then to validate the procedure in accord with these guidelines, or otherwise to justify continued use of the procedure in accord with Federal law. (2) When a standardized, formal or scored selection procedure is used for which it is not feasible or not appropriate to utilize the validation techniques contemplated by these guidelines, the user should either modify the procedure to eliminate the adverse impact or otherwise justify continued use of the procedure in accord with Federal law.

c. Generally where alternative selection procedures are available which have been shown to be equally valid for a given purpose, the user should use the procedure which has been demonstrated to have the lesser adverse impact. Accordingly, whenever a validity study is called for by these guidelines, the user should make a reasonable effort to investigate suitable alternative selection procedures which have as little adverse impact as possible, for the purpose of determining the appropriateness of using or validating them in accord with these guidelines. If a user has made a reasonable effort to become aware of such alternative procedures and a validity study for a job or group of jobs has been made in accord with these guidelines, the use of the selection procedure may continue until such time as it should reasonably be reviewed for currency. Whenever the user is shown a suitable alternative selection procedure with evidence of at least equal validity and less adverse impact, the user should investigate it for the

purpose of determining the appropriateness of using or validating it in accord with these guidelines. This subsection is not intended to preclude the combination of procedures into a significantly more valid procedure, if such a combination has been properly validated.

§ 4 Information on impact.

a. Each user should have available for inspection records or other information which will disclose the impact which its selection procedures have upon employment opportunities of persons by identifiable racial, ethnic or sex groups in order to determine compliance with the provisions of § 3 above. Where there are large numbers of applicants and procedures are administered frequently, such information may be retained on a sample basis, provided that the sample is appropriate in terms of the applicant population and adequate in size. The records called for by this section are to be maintained by sex, and by racial and ethnic groups as follows: blacks (Negroes), American Indians (including Alaska Natives), Asians (including Pacific Islanders), Hispanics (including persons of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish origin or culture regardless of race), whites (Caucasians) other than Hispanic and totals. The classifications called for by this section are intended to be consistent with the Employer Information (EEO-1 et seq.) series of reports. The user should adopt safeguards to insure that records of race, color, religion, sex, or national origin are used for appropriate purposes such as determining adverse impact, or (where required) for developing and monitoring affirmative action programs, and that such records are not used for making employment decisions.

b. The information called for by this section should be examined for possible adverse impact. If the records called for by this section indicate that the total selection process for a job has no adverse impact, the individual components of the selection process need not be evaluated separately for adverse impact. If a total selection process does have adverse impact, the individual components of the selection process should be evaluated for adverse impact.

A selection rate for any racial, ethnic or sex group which is less than four-fifths (80% or eighty percent) of the rate for the group with the highest rate will generally be regarded as evidence of adverse impact, while a greater than four-fifths rate will generally not be regarded as evidence of adverse impact. Smaller differences in selection rate may nevertheless be considered to constitute adverse impact, where they are significant in both statistical and practical terms. Greater differences in selection rate would not necessarily be regarded as constituting adverse impact where the differences are based on small numbers and are not statistically significant, or where special recruiting or other programs cause the pool of minority or female candidates to be atypical of the normal pool of applicants from that group.

c. Federal agencies responsible for the enforcement of the equal employment opportunity laws will consider in carrying out their obligations the general posture of the user with respect to equal employment opportunity for the job classification or group of classifications in question. Where a user has adopted an affirmative action program, the Federal agencies will consider the provisions of that program, including the goals and timetables which the employer has adopted and the progress which the employer has made in carrying out that program and in meeting the goals and timetables. These guidelines recognize that a user is prohibited by Federal law from the making of employ-

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ment decisions on the basis of race and color and (except for bona fide occupational qualifications) on the basis of sex, religion and national origin; and nothing in this subsection or in these guidelines is intended to encourage or permit the granting of preferential treatment to any individual or to any group because of the race, color, religion, sex or national origin of such individual or group.

§ 5 General standards for validity studies.

a. For the purposes of satisfying these guidelines users may rely upon criterion related validity studies, content validity studies or construct validity studies, in accordance with the standards set forth in Part II of these guidelines, § 12 *infra*.

b. These guidelines are intended to be consistent with generally accepted professional standards for evaluating standardized tests and other assessment techniques, such as those described in the Standards for Educational and Psychological Tests prepared by a joint committee of the American Psychological Association, the American Educational Research Association, and the National Council on Measurement in Education (Washington, D.C. 1974) (hereinafter "APA Standards"), and standard text books and journals in the field of personnel selection.

c. For any selection procedure which has an adverse impact each user should maintain and have available such documentation as is described in Part III of these guidelines, § 13 *infra*.

d. Selection procedures subject to validity studies under § 3a above should be administered and scored under standardized conditions.

e. In general, users should avoid making employment decisions on the basis of measures of knowledge, skills or abilities which are normally learned in a brief orientation period, and which have an adverse impact.

f. Where cut off scores are used, they should normally be set so as to be reasonable and consistent with normal expectations of acceptable proficiency within the work force. If other factors are used in determining cut off scores, such as the relationship between the number of vacancies and the number of applicants, the degree of adverse impact should be considered.

g. Selection procedures may be used to predict the performance of candidates for a job which is at a higher level than the job for which the person is initially being selected if a majority of the individuals who remain employed will progress to the higher level within a reasonable period of time. A "reasonable period of time" will vary for different jobs and employment situations but will seldom be more than five years. Examining for a higher level job would not be appropriate (1) if the majority of those remaining employed do not progress to the higher level job, (2) if there is a reason to doubt that the higher level job will continue to require essentially similar skills during the progression period, or (3) if knowledge, skills or abilities required for advancement would be expected to develop principally from the training or experience on the job.

h. Users may continue the use of a selection procedure which is not at the moment fully supported by the required evidence of validity, provided: (1) the user can cite substantial evidence of validity in accord with these guidelines and (2) the user has in progress, when technically feasible, studies which are designed to produce the additional data required within a reasonable time.

If the additional studies do not produce the data required to demonstrate validity, the user is not relieved of or protected against any obligations arising under Federal law.

i. Whenever a validity study has been made in accord with these guidelines for the use of a particular selection procedure for a job or group of jobs, additional studies need not be performed until such time as the validity study is subject to review as provided in § 3c above. There are no absolutes in the area of determining the currency of a validity study. All circumstances concerning the study, including the validation strategy used, and changes in the relevant labor market and the job should be considered in the determination of when a validity study is outdated.

§ 6 Cooperative validity studies and use of other validity studies.

a. It is the intent of the agencies issuing these guidelines to encourage and facilitate cooperative development and validation efforts by employers, labor organizations and employment agencies to achieve selection procedures which are consistent with these guidelines.

b. Criterion-related validity studies conducted by one test user, or described in test manuals and the professional literature, will be considered acceptable for use by another user when: (1) the weight of the evidence from studies meeting the standards of § 12b below shows that the selection procedure is valid; (2) the studies pertain to a job which has substantially the same major job duties as shown by appropriate job analyses and (3) the studies included a study of test fairness for those racial, ethnic and sex subgroups which constitute significant factors in the borrowing user's relevant labor market for the jobs or jobs in question. If the studies relied upon satisfy (1) and (2) above but do not contain an investigation of test fairness, and it is not technically feasible for the borrowing user to conduct an internal study of test fairness, the borrowing user may utilize the study until studies conducted elsewhere show test unfairness, or until such time as it becomes technically feasible to conduct an internal study of test fairness and the results of that study can be acted upon.

If it is technically feasible for a borrowing user to conduct an internal validity study, and there are variables in the other studies which are likely to affect validity significantly, the user may rely upon such studies only on an interim basis in accord with § 5h, and will be expected to conduct an internal validity study in accord with § 12b below. Otherwise the borrowing user may rely upon such acceptable studies for operational use without an internal study.

c. Selection procedures shown by one user to be content valid in accord with § 12c will be considered acceptable for use by another user for a performance domain if the borrowing user's job analysis shows that the same performance domain is measured by the selection procedure.

d. The conditions under which findings of construct validity may be generalized are described in § 12d(4).

e. If validity evidence from a multitrait or cooperative study satisfies the requirements of subparagraphs b, c or d above, evidence of validity specific to each unit or user usually will not be required unless there are variables in the units not studied which are likely to affect validity significantly.

§ 7 No assumption of validity.

a. Under no circumstances will the general reputation of a selection procedure, its author or its publisher, or casual reports of its validity be accepted in lieu of evidence of validity. Specifically ruled out are: assumptions of validity based on a procedure's name or descriptive labels; all forms of pro-

motional literature; data bearing on the frequency of a procedure's usage; testimonial statements and credentials of sellers, users, or consultants; and other non-empirical or anecdotal accounts of selection practices or selection outcomes.

b. Professional supervision of selection activities is encouraged but is not a substitute for documented evidence of validity. The enforcement agencies will take into account the fact that a thorough job analysis and careful development of a selection procedure enhances the probability that the selection procedure is valid for the job.

§ 8 Employment agencies and employment services.

a. An employment agency, including private employment agencies and State employment agencies which agrees to a request by an employer or labor organization to devise and utilize a selection procedure should follow the standards for determining adverse impact and, if adverse impact is demonstrated, show validity as set forth in these guidelines. An employment agency is not relieved of its obligation herein because the user did not request such validation or has requested the use of some lesser standard of validation than is provided in these guidelines. The use of an employment agency does not relieve an employer or labor organization of its responsibilities under Federal law to provide equal employment opportunity or its obligations as a user under these guidelines.

b. Where an employment agency or service is requested to administer a select program which has been devised elsewhere and to make referrals pursuant to the results, the employment agency or service should obtain evidence of the absence of adverse impact, or of validity, as described in these guidelines, before it administers the selection program and makes referrals pursuant to the results. The employment agency must furnish on request such evidence of validity. An employment agency or service will be expected to refuse to make referrals based on the selection procedure where the employer or labor organization does not supply satisfactory evidence of validity or lack of adverse impact.

§ 9 Disparate treatment.

The principle of disparate or unequal treatment must be distinguished from the concepts of validation. A selection procedure—even though validated against job performance in accordance with the guidelines in this part—cannot be imposed upon members of a racial, sex or ethnic group where other employees, applicants or members have not been subjected to that standard. Disparate treatment, for example, occurs where members of a racial, sex or ethnic group have been denied the same employment, promotion, transfer or membership opportunities as have been made available to other employees or applicants. Those employees or applicants who have been denied equal treatment, because of prior discriminatory practices or policies, must at least be afforded the same opportunities as had existed for other employees or applicants during the period of discrimination. Thus, the persons who were in the class of persons discriminated against and were available in the relevant job market during the period the user followed the discriminatory practices should be afforded the opportunity to qualify under the less stringent selection procedures previously followed, unless the user demonstrates that the increased standards are required for the safety or efficiency of the operation. Nothing in this section is intended to prohibit a user who has not previously followed merit standards from adopting merit standards; nor does it preclude a user who has previously used invalid or unvalidated selection procedures

from developing and using procedures which are validated in accord with these guidelines.

§ 10 Retesting.

Users should provide a reasonable opportunity for retesting and reconsideration. The user may however take reasonable steps to preserve the security of the procedure. When examinations are administered periodically with public notice, such reasonable opportunity exists, unless persons who have previously been tested are precluded from retesting.

§ 11 Affirmative action.

The use of selection procedures which have been validated pursuant to these guidelines does not relieve users of any obligations they may have to undertake affirmative action to assure equal employment opportunity. Nothing in these guidelines is intended to preclude the use of selection procedures (consistent with Federal law—see § 4c) which assist in the achievement of affirmative action objectives.

PART II TECHNICAL STANDARDS

§ 12 Technical standards for validity studies.

The following minimum standards, as applicable, should be met in conducting a validity study. Nothing in these guidelines is intended to preclude the development and use of other professionally acceptable techniques with respect to validation of selection procedures.

a. Any validity study should be based upon a review of information about the job for which the selection procedure is to be used. The review should include a job analysis except as provided in § 12b(3) below with respect to criterion-related validity. Any method of job analysis may be used if it provides the information required for the specific validation strategy used.

b. Criterion-Related Validity.

(1) Users choosing to validate a selection procedure by a criterion-related validity strategy should determine whether it is technically feasible (as defined in Part IV) to conduct such a study in the particular employment context. These guidelines do not require a user to hire or promote persons for the purpose of making it possible to conduct a criterion-related study; and do not require such a study on a sample of less than thirty (30) persons. The determination of the number of persons necessary to permit the conduct of a meaningful criterion-related study should be made by the user on the basis of all relevant information concerning the selection procedure, the potential sample and the employment situation.

(2) There should be a review of job information to determine measures of work behaviors or performance that are relevant to the job in question. These measures or criteria are relevant to the extent that they represent critical or important job duties, work behaviors or work outcomes as developed from the review of job information. The possibility of bias should be considered both in selection of the measures and their application. In view of the possibility of bias in subjective evaluations, supervisory rating techniques should be carefully developed. All criteria need to be examined for freedom from factors which would unfairly alter scores of any group. The relevance of criteria and their freedom from bias are of particular concern when there are significant differences in measures of job performance for different groups.

(3) Proper safeguards should be taken to insure that scores on selection procedures do not enter into any judgments of employee adequacy that are to be used as criterion measures. Criteria may consist of measures

other than work proficiency including, but not limited to length of service, regularity of attendance, training time or properly measured success in job relevant training. Measures of training success based upon pencil and paper tests will be closely reviewed for job relevance. Whatever criteria are used should represent important or critical work behaviors or work outcomes, job behaviors including but not limited to production rate, error rate, tardiness, absenteeism and turnover, may be used as criteria without a full job analysis if the user can show the importance of the criterion to the particular employment context. A standardized rating of overall work performance may be utilized where a study of the job shows that it is an appropriate criterion.

(4) The sample subjects should insofar as feasible be representative of the candidates normally available in the relevant labor market for the job or jobs in question, and should insofar as feasible include the racial, ethnic and sex groups normally available in the relevant job market. Where samples are combined or compared, attention should be given to see that such samples are comparable in terms of the actual job they perform, the length of time on the job where time on the job is likely to affect performance and other relevant factors likely to affect validity differences.

(5) The degree of relationship between selection procedure scores and criterion measures should be computed, using professionally acceptable statistical procedures. Generally, a selection procedure is considered related to the criterion, for the purposes of these guidelines, when the relationship between performance on the procedure and performance on the criterion measure is statistically significant at the .05 level of significance, which means that it is sufficiently high as to have a probability of no more than one (1) in twenty (20) to have occurred by chance.

Users should evaluate each selection procedure to assure that it is appropriate for operational use. Generally, if other factors remain the same, the greater the magnitude of the relationship (e.g., correlation coefficient) between performance on a selection procedure and one or more criteria of performance on the job, and the greater the importance or number of aspects of job performance covered by the criteria, the more likely it is that the procedure will be appropriate for use. Reliance upon a selection procedure which is significantly related to a criterion measure, but which is based upon a study involving a large number of subjects and has a low correlation coefficient will be subject to close review if it has a large adverse impact. Sole reliance upon a single selection instrument which is related to only one of many job duties or aspects of job performance will also be subject to close review. The appropriateness of a selection procedure is best evaluated in each particular situation and there are no minimum correlation coefficients applicable to all employment situations. In determining whether a selection procedure is appropriate for operational use the following considerations should also be taken into account: the degree of adverse impact of the procedure, the availability of other selection procedures of greater or substantially equal validity; and the need for an employer, required by law or regulation to follow merit principles, to have an objective system of selection.

(6) Users should avoid reliance upon techniques which tend to inflate validity estimates as a result of capitalization on chance unless an appropriate safeguard is taken. Reliance upon a few selection procedures or criteria of successful job performance, when many selection procedures or criteria of performance have been studied, or the use of

optimal statistical weights for selection procedures computed in one sample, are techniques which tend to inflate validity estimates as a result of chance. Use of a large sample is one safeguard; cross-validation is another. A sufficient formula for multiple correlation is also an appropriate safeguard which inflates validity estimates when selection procedures were computed in one sample.

(7) *Fairness of the Selection Procedure.*
i. When members of one racial, ethnic, or sex group characteristically obtain lower scores on a selection procedure than members of another group, and the differences are not reflected in differences in measures of job performance, use of the selection procedure may unfairly deny opportunities to members of the group that obtains the lower scores.

ii. Where a selection procedure results in an adverse impact on a racial, ethnic or sex group identified in accordance with the classifications set forth in § 4 above and that group is a significant factor in the relevant labor market, the user generally should investigate the possible existence of test unfairness for that group if it is technically feasible to do so.

The greater the severity of the adverse impact on a group, the greater the need to investigate the possible existence of test unfairness. Where the weight of evidence from other studies shows that the selection procedure is a fair predictor for the group in question and for the same or similar jobs, such studies may be relied on in connection with the test at issue; however, where the severity of adverse impact on a group is significantly greater than in the other studies referred to, a user may not rely on such other studies.

iii. Users conducting a study of test fairness should review the APA Standards regarding investigation of possible bias in testing. An investigation of fairness of a selection procedure depends on both evidence of validity and the manner in which the selection procedure is to be used in a particular employment context. Fairness of a selection procedure cannot necessarily be specified in advance without investigating these factors. Investigation of test fairness in samples where the range of scores on selection procedures or criterion measures is severely restricted for any subgroup sample (as compared to other subgroup samples) may produce misleading evidence of test unfairness. That factor should accordingly be taken into account in conducting such studies and before reliance is placed on the results.

iv. If test unfairness is demonstrated through a showing that members of a particular group perform better or poorer on the job than their scores on the selection procedure would indicate through comparison with how members of other groups perform, the user may either revise or replace the selection instrument in accordance with these guidelines, or may continue to use the selection instrument operationally with appropriate revisions in its use to assure compatibility between the probability of successful job performance and the probability of being selected.

v. In addition to the general conditions needed for technical feasibility for the conduct of a criterion-related study (see § 14(j), below) an investigation of test fairness requires the following:

(1) a sufficient number of persons in each group for findings of statistical significance. These guidelines do not require a user to hire or promote persons on the basis of group classifications for the purpose of making it possible to conduct a study of test fairness; and do not require a user to conduct a study of test fairness on a sample of less than thirty (30) persons for each group involved in the study.

(2) The samples for each group should be comparable in terms of the actual job they perform, length of time on the job where time on the job is likely to affect performance, and other relevant factor likely to affect validity differences.

vi. If a study of test fairness should otherwise be performed, but is not technically feasible, the use of a selection procedure which has otherwise met the validity standards of these guidelines will be considered in accord with these guidelines, unless the technical infeasibility resulted from discriminatory employment practices which are demonstrated by facts other than past failure to conform with requirements for validation of selection procedures. However, when it becomes technically feasible for the user to perform a study of test fairness and such a study is otherwise called for, the user should conduct the study of test fairness.

c. *Content validity.*

(1) There should be a definition of a performance domain or the performance domains with respect to the job in question. Performance domains may be defined through job analysis, analysis of the work behaviors or activities, or by the pooled judgments of persons having knowledge of the job. Performance domains should be defined on the basis of competent information about job tasks and responsibilities. Performance domains include critical or important work behaviors, work products, work activities, job duties, or the knowledge, skills or abilities shown to be necessary for performance of the duties, behaviors, activities or the production of work. Where a performance domain has been defined as a knowledge, skill or ability, that knowledge, skill or ability must be used in job behavior. A selection procedure based on inferences about psychological processes cannot be supported by content validity alone. Thus content validity by itself is not an appropriate validation strategy for intelligence, aptitude, personality or interest tests. Content validity is also not an appropriate strategy when the selection procedure involves knowledge, skills or abilities which an employee will be expected to learn on the job.

(2) If a higher score on a content valid selection procedure can be expected to result in better job performance the results may be used to rank persons who score above minimum levels. Where a selection procedure supported solely by content validity is used to rank job candidates, the performance domain should include those aspects of performance which differentiate among levels of job performance.

(3) A selection procedure which is a representative sample of a performance domain of the job as defined in accordance with subsection (1) above, is a content valid procedure for that domain. Where the domain or domains measured are critical to the job, or constitute a substantial proportion of the job, the selection procedure will be considered to be content valid for the job. The reliability of selection procedures justified on the basis of content validity should be a matter of concern to the user. Whenever it is feasible to do so, appropriate statistical estimates should be made of the reliability of the selection procedures.

(4) A demonstration of the relationship between the content of the selection procedure and the performance domain of the job is critical to content validity. The closer the content of the selection procedure is to actual work samples, behaviors or activities, the stronger is the basis for showing content validity. Content validity may also be shown if the knowledge, skills or abilities demonstrated in and measured by the selection procedure are the same as or similar to the knowledge, skills or abilities shown to be

necessary for job performance. The need for careful documentation of the relationship between the performance domain of the selection procedure and that of the job increases as the content of the selection procedure less resembles that of the job performance domain.

(5) A requirement for specific prior training or for work experience based on content validity, including a specification of level or amount of training or experience, should be justified on the basis of the relationship between the content of the training or experience and the performance domain of the job for which the training or experience is to be required.

(6) If a selection procedure is supported solely on the basis of content validity, it may be used operationally if it represents a critical performance domain or a substantial proportion of the performance domains of the job.

d. *Construct Validity.* Construct validity is a more complex strategy than either criterion-related or content validity. Accordingly, users choosing to validate a selection procedure by use of this strategy should be careful to follow the professionally accepted standards, such as those contained in the APA Standards and the standard text books and journals.

(1) There should be a job analysis. This job analysis should result in a determination of the constructs that underlie successful performance of the important or critical duties of the job.

(2) A selection procedure should be selected or developed which measures the construct(s) identified in accord with subparagraph (1) above.

(3) The selection procedure may be used operationally if the standards of subparagraphs (1) and (2) are met and there is sufficient empirical research evidence showing that the procedure is validly related to performance of critical job duties. Normally, sufficient empirical research evidence would take the form of one or more criterion related validity studies meeting the requirements of § 12b. See also second sentence of § 12.

(4) Where a selection procedure satisfies the standards of subsections (1), (2) and (3) above, it may be used operationally for other jobs which are shown by an appropriate job analysis to include the same construct(s) as an essential element in job performance.

PART III

DOCUMENTATION OF VALIDITY EVIDENCE

§ 13a. For each selection procedure having an adverse impact (as set forth in § 4) the user should maintain and have available the data on which the adverse impact determination was made and one of the following types of documentation evidence:

(1) Documentation evidence showing criterion related validity of the selection procedure (see § 13b, *infra*).

(2) Documentation evidence showing content validity of the selection procedure (see § 13c, *infra*).

(3) Documentation evidence showing construct validity of the selection procedure (see § 13d, *infra*).

(4) Documentation evidence from other studies showing validity of the selection procedure in the user's facility (see § 13e, *infra*).

(5) Documentation evidence showing what steps were taken to reduce or eliminate adverse impact, why validation is not feasible or not appropriate and why continued use of the procedure is consistent with Federal law.

This evidence should be compiled in a reasonably complete and organized manner

to permit direct evaluation of the validity of the selection procedure. Previously written employer or consultant reports of validity are acceptable if they are complete in regard to the following documentation requirements, or if they satisfied requirements of guidelines which were in effect when the study was completed. If they are not complete, the required additional documentation should be appended. If necessary information is not available the report of the validity study may still be used as documentation, but its adequacy will be evaluated in terms of compliance with the requirements of these guidelines.

In the event that evidence of validity is reviewed by an enforcement agency, the reports submitted are expected to use one of the formats set forth below. Evidence denoted by use of the word "ESSENTIAL" is considered critical and reports not containing such information will be considered incomplete. Evidence not so denoted is desirable, but its absence will not be a basis for considering a report incomplete.

b. *Criterion-related validity.* Reports of criterion-related validity of selection procedures are to contain the following information:

(1) *Users(s), and Location(s) and Date(s) of Study.* Dates of administration of selection procedures and collection of criterion data and, where appropriate, the time between collection of data on selection procedures and criterion measures should be shown (ESSENTIAL). If the study was conducted at several locations, the address of each location, including city and state, should be shown.

(2) *Problem and Setting.* An explicit definition of the purpose(s) of the study and the circumstances in which the study was conducted should be provided. A description of existing selection procedures and cut-off scores, if any, should be provided.

(3) *Review of Job Information or Job Analysis.* Where a review of job information results in criteria which are measures other than work proficiency (see 12(b)(3)), the basis for the selection of these criteria should be reported (ESSENTIAL). Where a job analysis is required, the report should include either: (a) the important duties performed on the job and the basis on which such duties were determined to be important, such as the proportion of time spent on the respective duties, their level of difficulty, their frequency of performance, the consequences of error, or other appropriate factors; or (b) the knowledge, skills, abilities and/or other worker characteristics and bases on which they were determined to be important for job performance (ESSENTIAL). Published descriptions from industry sources or Volume I of the Dictionary of Occupational Titles Third Edition, United States Government Printing Office, 1965, are satisfactory if they adequately and completely describe the job. If appropriate, a brief supplement to the published description should be provided.

If two or more jobs are grouped for a validity study, a justification for this grouping, as well as a description of each of the jobs, should be provided (ESSENTIAL).

(4) *Job Titles and Codes.* It is desirable to provide the user's job title(s) for the job(s) in question and the corresponding job title(s) and code(s) from United States Employment Service Dictionary of Occupational Titles Volumes I & II. Where standard titles and codes do not exist, a notation to that effect should be made.

(5) *Criteria.* A full description of all criteria on which data were collected, including a rationale for selection of the final criteria, and means by which they were ob-

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served, recorded, evaluated and quantified, should be provided (ESSENTIAL). If rating techniques are used as criterion measures the appraisal form(s) and instructions to the rater(s) should be included as part of the validation evidence (ESSENTIAL).

(5) *Sample.* A description of how the research sample was selected should be included (ESSENTIAL). The racial, ethnic and sex composition of the sample should be described, including the size of each subgroup (ESSENTIAL). Racial and ethnic classifications should be those set forth in 14a above. A description of how the research sample compares with the racial, ethnic and sex composition of the relevant labor market is also desirable. Where data are available, the racial, ethnic and sex composition of current applicants should also be described. Descriptions of educational levels, length of service, and age are also desirable.

(7) *Selection Procedure.* Any measure, combination of measures, or procedures used as a basis for employment decisions should be completely and explicitly described or attached (ESSENTIAL). If commercially available selection procedures are used, they should be described by title, form, and publisher (ESSENTIAL). Reports of reliability estimates and how they were established are desirable. A rationale for choosing the selection procedures investigated in the study should be included.

(8) *Techniques and results.* Methods used in analyzing data should be described (ESSENTIAL). Measures of central tendency (e.g., means) and measures of dispersion (e.g., standard deviations and ranges) for all selection procedures and all criteria should be reported for all relevant racial, ethnic and sex subgroups (ESSENTIAL). Statistical results should be organized and presented in tabular or graphical form, by racial, ethnic and/or sex subgroups (ESSENTIAL). All selection procedure-criterion relationships investigated should be reported, including their magnitudes and directions (ESSENTIAL). Statements regarding the statistical significance of results should be made (ESSENTIAL).

Any statistical adjustments, such as for less than perfect reliability or for restriction of score range in the selection procedure or criterion, or both, should be described; and uncorrected correlation coefficients should also be shown (ESSENTIAL). Where the statistical technique used categorizes continuous data, such as bisection correlation and the phi coefficient, the categories and the bases on which they were determined should be described (ESSENTIAL). Studies of test fairness should be included where called for by the requirements of Section 12b(7) (ESSENTIAL). These studies should include the rationale by which a selection procedure was determined to be fair to the group(s) in question. Where test fairness has been demonstrated on the basis of other studies, a bibliography of the relevant studies should be included (ESSENTIAL). If the bibliography includes unpublished studies, copies of these studies, or adequate abstracts or summaries, should be attached (ESSENTIAL). Where revisions have been made in a selection procedure to assure comparability between successful job performance and the probability of being selected, the studies underlying such revisions should be included (ESSENTIAL).

(9) *Uses and Applications.* A description of the way in which each selection procedure is to be used (e.g., as a screening device with a cut-off score or combined with other procedures in a battery) and application of the procedure (e.g., selection, transfer, promotion) should be provided (ESSENTIAL). If weights are assigned to different parts of the selection procedure, these weights and the

validity of the weighted composite should be reported (ESSENTIAL).

(10) *Cut-off Scores.* Where cut-off scores are to be used, both the cut-off scores and the way in which they were determined should be described (ESSENTIAL).

(11) *Source Data.* Each user should maintain records showing all pertinent information about individual sample members in studies involving the validation of selection procedures. These records (exclusive of names and social security numbers) should be made available upon request of a compliance agency. These data should include selection procedure scores, criterion scores, age, sex, minority group status, and experience on the specific job on which the validation study was conducted and may also include such things as education, training, and prior job experience. If the user chooses to include, along with a report on validation, a worksheet showing the pertinent information about the individual sample members, specific identifying information such as name and social security number should not be shown. Inclusion of the work sheet with the validity report is encouraged in order to avoid delays.

(12) *Contact Person.* It is desirable for the user to set forth the name, mailing address, and telephone number of the individual who may be contacted for further information about the validity study.

c. *Content Validity.* Reports of content validity of selection procedures are to contain the following information:

(1) *Definition of Performance Domain.* A full description should be provided for the basis on which a performance domain is defined (ESSENTIAL). A complete and comprehensive definition of the performance domain should also be provided (ESSENTIAL). The domain should be defined on the basis of competent information about job tasks and responsibilities (ESSENTIAL). Where the performance domain is defined in terms of knowledge, skills, or abilities, there should be an operational definition of each knowledge, skill or ability and a complete description of its relationship to job duties, behaviors, activities, or work products (ESSENTIAL).

(2) *Job Title and Code.* It is desirable to provide the test user's job title(s) and the corresponding job title(s) and code(s) from the United States Employment Service Dictionary of Occupational Titles Volumes I & II. Where standard titles and codes do not exist, a notation to that effect should be made.

(3) *Selection Procedures.* Selection procedures including those constructed by or for the test user, specific training requirements, composites of selection procedures, and any other procedure for which content validity is asserted should be completely and explicitly described or attached (ESSENTIAL). If commercially available selection procedures are used, they should be described by title, form, and publisher (ESSENTIAL). Where the performance domain is defined in terms of knowledge, skills or abilities, evidence that the selection procedure measures those knowledges, skills or abilities should be provided (ESSENTIAL).

(4) *Techniques and Results.* The method by which the correspondence between the content of the selection procedure and the job performance domain(s) was established and the relative emphasis given to various aspects of the content of the selection procedure as derived from the performance domain(s) should be described (ESSENTIAL). If any steps were taken to reduce adverse racial, ethnic, or sex impact in the content of the procedure or in its administration, these steps should be described. Establishment of time limits, if any, and how these limits are related to the speed with which duties must be performed on the job, should be explained.

The adequacy of the sample coverage of the performance domain should be described as precisely as possible. Measures of central tendency (e.g., means) and measures of dispersion (e.g., standard deviations) should be reported for all selection procedures as appropriate. Such reports should be made for all relevant racial, ethnic, and sex subgroups, at least on a statistically reliable sample basis.

(5) *Uses and Applications.* A description of the way in which each selection procedure is to be used (e.g., as a screening device with a cut-off score or combined with other procedures in a battery) and the application of the procedure (e.g., selection, transfer, promotion) should be provided (ESSENTIAL).

(6) *Cut-off Scores.* The rationale for minimum scores, if used, should be provided (ESSENTIAL). If the selection procedure is used to rank individuals above minimum levels, or if preference is given to individuals who score significantly above the minimum levels, a rationale for this procedure should be provided (ESSENTIAL).

(7) *Contact person.* It is desirable for the employer to set forth the name, mailing address and telephone number of the individual who may be contacted for further information about the validation study.

d. *Construct Validity.* Reports of construct validity of selection procedures are to contain the following information:

(1) *Construct Definition.* A complete, operational definition of the construct should be provided, including levels of construct performance relevant to the job(s) for which it is to be used as a selection procedure (ESSENTIAL).

(2) *Job Analysis.* The job analysis should show how the constructs underlying successful job performance of important or critical duties were determined (ESSENTIAL). The job analysis should provide evidence of the linkage between the construction and the important duties of the job and how this linkage was determined (ESSENTIAL).

(3) *Job Titles and Codes.* It is desirable to provide the selection procedure user's job title(s) for the job(s) in question and the corresponding job title(s) and code(s) from the United States Employment Service Dictionary of Occupational Titles, Volumes I & II. Where standard titles and codes do not exist, a notation to that effect should be made.

(4) *Selection Procedure.* The selection procedure used as a measure of the construct should be completely and explicitly described or attached (ESSENTIAL). If commercially available selection procedures are used, they should be identified by title, form and publisher (ESSENTIAL). The evidence demonstrating that the selection procedure is in fact a proper measure of the construct should be included (ESSENTIAL). Reports of reliability estimates and how they were established are desirable.

(5) *Anchoring.* The empirical evidence showing that performance on the selection procedure is validly related to performance of critical job duties should be included (ESSENTIAL).

(6) *Uses and Applications.* A description of the way in which each selection procedure is to be used (e.g., as a screening device with a cut-off score or combined with other procedures in a battery) and application of the procedure (e.g., selection, transfer, promotion) should be provided (ESSENTIAL). If weights are assigned to different parts of the selection procedure, these weights (and the validity of the weighted composite) should be reported (ESSENTIAL).

(7) *Cut-off Scores.* Where cut-off scores are to be used, both the cut-off scores and the way in which they were determined should be described (ESSENTIAL).

(8) *Source Data.* Each user should maintain records showing all pertinent information about individual sample members in studies involving the validation of selection procedures. These records (exclusive of names and social security number) should be made available upon request of a compliance agency. These data should include selection procedure scores, criterion scores, age, sex, minority group status, and experience on the specific job on which the validation study was conducted and may also include such things as education, training, and prior job experience. If the user chooses to include, along with a report on validation, a worksheet showing the pertinent information about the individual sample members, specific identifying information such as name and social security number should not be shown. Inclusion of the worksheet with the validity report is encouraged in order to avoid delays.

(9) *Contact Person.* It is desirable for the user to set forth the name, mailing address, and telephone number of the individual who may be contacted for further information about the validity study.

c. *Evidence of Validity from other Studies.* When validity of a selection procedure is supported by studies not done by the user, the evidence from the original study or studies should be compiled in a manner similar to that required in the appropriate section of this § 13 above. In addition, the following evidence should be supplied:

(1) *Evidence from Criterion-related Validity Studies.*

(i) *Job Information.* A description of the important duties of the user's job and the basis on which the duties were determined to be important should be provided (ESSENTIAL). A full description of the basis for determining that these important job duties are sufficiently similar to the duties of the job in the original study (or studies) to warrant use of the selection procedure in the new situation should be provided (ESSENTIAL).

(ii) *Relevance of Criteria.* A full description of the basis on which the criteria used in the original studies are determined to be relevant for the user should be provided (ESSENTIAL).

(iii) *Other Variables.* The similarity of important applicant pool/sample characteristics reported in the original studies to those of the user should be described (ESSENTIAL). A description of the comparison between the race and sex composition of the user's relevant labor market and the sample in the original validity studies should be provided (ESSENTIAL).

(iv) *Use of the Selection Procedure.* A full description should be provided showing that the use to be made of the selection procedure is consistent with the findings of the original validity studies (ESSENTIAL).

(v) *Bibliography.* A bibliography of reports of validity of the selection procedure for the job or jobs in question should be provided (ESSENTIAL). Where any of the studies included an investigation of test fairness, the results of this investigation should be provided (ESSENTIAL). Copies of reports published in journals that are not commonly available should be described in detail or attached (ESSENTIAL). Where a user is relying upon unpublished studies, a rea-

sonable effort should be made to obtain these studies. If these unpublished studies are the sole source of validity evidence they should be described in detail or attached (ESSENTIAL). If these studies are not available, the name and address of the source, an adequate abstract or summary of the validity study and data, and a contact person in the source organization should be provided (ESSENTIAL).

(2) *Evidence from Content Validity Studies.*

(i) *Similarity of Performance Domains.* A full description should be provided of the similarity between the performance domain in the user's job and the performance domain measured by a selection procedure developed and shown to the content valid by another user (ESSENTIAL). The basis for determining this similarity should be explicitly described (ESSENTIAL).

(3) *Evidence from Construct Validity Studies.*

(i) *Uniformity of Construct.* A full description should be provided of the basis for determining that the construct identified as underlying successful job performance by the user's job analysis is the same as the construct measured by the selection procedure (ESSENTIAL).

PART IV—DEFINITIONS

§ 14 The following definitions shall apply throughout these guidelines:

(a) *Ability:* The present observable competence to perform a function.

(b) *Adverse Impact:* Defined in § 4 of these guidelines.

(c) *Employer:* Any employer subject to the provisions of the Civil Rights Act of 1964, as amended, including state or local government and any Federal agency subject to the provisions of Sec. 717 of the Civil Rights Act of 1964, as amended, and any Federal contractor or subcontractor or federally assisted construction contractor or subcontractor covered by Executive Order 11246, as amended.

(d) *Employment agency:* Any employment agency subject to the provisions of the Civil Rights Act of 1964, as amended.

(e) *Enforcement Agency:* Any agency of the executive branch of the Federal Government which issues these guidelines, or which has responsibility for securing compliance with them.

(f) *Labor organization:* Any labor organization subject to the provisions of the Civil Rights Act of 1964, as amended, and any committee controlling apprenticeship or other training.

(g) *Racial, sex or ethnic group:* Any group of persons identifiable on the grounds of race, color, religion, sex or national origin.

(h) *Selection procedure:* Any measure, combination of measures, or procedure, other than a bona fide seniority system, used as a basis for any employment decision. Selection procedures include the full range of assessment techniques from traditional paper and pencil tests, performance tests, training programs or probationary periods and physical, educational and work experience requirements through informal or casual interviews and unrecorded application forms.

(i) *Selection rate:* The proportion of applicants or candidates who are hired, promoted or otherwise selected.

(j) *Technical feasibility:* The existence of conditions permitting the conduct of meaningful criterion related validity studies. These conditions include: (a) an adequate

sample of persons available for the study to achieve findings of statistical significance; (b) having or being able to obtain a sufficient range of sources on the selection procedure and job performance measures to produce validity results which can be expected to be representative of the results if the ranges normally expected were utilized; and (c) having or being able to devise unbiased, reliable and relevant measures of job performance or other criteria of employee adequacy. See § 12b(4). With respect to investigation of possible unfairness, the same considerations are applicable to each group for which the study is made. See § 12b(7).

(k) *Unfairness of Selection Procedure (differential prediction):* A condition in which members of one racial, ethnic, or sex group characteristically obtain lower scores on a selection procedure than members of another group, and the differences are not reflected in differences in measures of job performance. See § 12a(6).

(l) *User:* Any employer, labor organization, employment agency, or licensing or certification board, to the extent it may be covered by Federal equal employment opportunity law which uses a selection procedure as a basis for any employment decision. Whenever an employer, labor organization, or employment agency is required by law to restrict recruitment for any occupation to those applicants who have met licensing or certification requirements, the licensing or certifying authority to the extent it may be covered by Federal equal employment opportunity law will be considered the user with respect to those licensing or certification requirements. Whenever a state employment agency or service does no more than administer or monitor a procedure as permitted by Department of Labor regulations, and does so without making referrals or taking any other action on the basis of the results, the state employment agency will not be deemed to be a user.

[FR Doc. 76-20307 Filed 7-13-76; 8:45 am]

FEDERAL ENERGY ADMINISTRATION

APPEALS AND APPLICATIONS FOR EXCEPTION OR OTHER RELIEF

Cases Filed

WEEK OF JUNE 25 THROUGH JULY 2, 1976

Notice is hereby given that during the week of June 25 through July 2, 1976 the appeals and applications for exception or other relief listed in the Appendix to this notice were filed with the Federal Energy Administration's Office of Exceptions and Appeals.

Under the FEA's procedural regulations, 10 CFR, Part 205, any person who will be aggrieved by the FEA action sought in such cases may file with the FEA written comments on the application within ten days of service of notice, as prescribed in the procedural regulations. For purposes of those regulations, the date of service of notice shall be deemed to be the date of publication of this notice or the date of receipt by an aggrieved person of actual notice, whichever occurs first.

MICHAEL P. BUTLER,
General Counsel.

JULY 8, 1976.

NATIONAL OCCUPATIONAL COMPETENCY TESTING INSTITUTE
45 Colvin Avenue Albany, New York 12206 (518) 482-8864



NOCTI TEST SERIES

CUMULATIVE NATIONAL NORMS

Spring 1974 Thru Spring 1976

Prepared by

Dr. Leon S. Tunkel, Director, NOCTI
Dr. Raymond S. Klein, Industrial Psychologist

Technical Assistance & Computer Services

Mr. Robert Pfeiffer, Manager Academic Services
Programming, State University of New York at Albany

September 1976

INTRODUCTION TO TECHNICAL DATA RELATED
TO THE NOCTI TEST SERIES

The tables in this booklet provide test users with both percent scores and standard scores (percentile norms, T score) for 24 written and 24 performance tests. These tables were developed with an N=2140. The tables have been arranged in such a manner that an appropriate standard score can be determined by locating the percent score on either side of the table, and then read across to the appropriate test and column. For standard scores which fall between the measures given, interpolation is required. These standard scores were updated August, 1976. In addition, selected measures have been presented which summarize the data obtained during the development phase of the written test series. Finally, Cumulative National data (Spring 1974 - Spring 1976) is provided indicating the range, mean, standard deviation, and median of both written and performance tests.

The contents of the examinations were derived through occupational analyses, which examined the frequency and importance of specific occupational skills, understandings, and trade knowledge. The analyses were developed by trade committees which arrive at consensus of findings and assigned the development of appropriate questions to experts. Additional committee reviews were made prior to pilot testing of the instruments in settings across the United States. The results from pilot testing were analyzed using item analysis and the standard reliability techniques KR20 and 21. This work was performed at the Instructional Materials Laboratory at Ohio State University. Adjustments in instruments were made and final tests were offered for use. Candidates who are interested in qualifying for teaching positions in trade and technical areas have comprised the chief population for these tests, to date. The Department of Defense has undertaken pilot use of these exams to test job acquired learnings so that transfer credit might be earned by servicemen desiring college credit. Two and four-year colleges have used these exams for the purposes of determining advanced standing of candidates.

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NATIONAL OCCUPATIONAL COMPETENCY TESTING INSTITUTE

LIST OF NOCTI TESTS AND CODES

Table 1

CODE	TEST SERIES
ACON	Air Conditioning and Refrigeration
AIRFR	Airframe and Powerplant
ARCHD	Architectural Drafting
AUTOB	Auto Body Repair
AMECH	Auto Mechanic
CMAKE	Cabinet Making and Millwork
CARP	Carpentry
CTECH	Civil Technology
COSMO	Cosmetology
DIENG	Diesel Engine Repair
ESTAL	Electrical Installation
ELCOM	Electronics Communications
IELAN	Industrial Electrician
IERIC	Industrial Electronics
MACHD	Machine Drafting
MACHT	Machine Trades
MASON	Masonry
MECHT	Mechanical Technology
PLUMB	Plumbing
PRINT	Printing
QFOOD	Quantity Food Preparation
SHEET	Sheet Metal
SENG	Small Engine Repair
WELD	Welding

Table 2

SUMMARY OF STANDARD SCORES FOR 24 NOCTI WRITTEN TESTS

Key:
 *PCT = Percent Score Achieved
 %L = National Percentile Rank
 T = "T" Score with mean of 50 and a standard deviation of 10
 ACON= See Table 1 for Names of Tests

* PCT	ACON	AIRFR	ARCHD	AUTOB	AMECH	CMAKE	C.RP	CTECH	COSMO	DIENG	ESTAL	ELCOM	PCT
%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T
100	99 84	99 80	99 83	99 93	99 88	99 91	99 71	99 88	99 76	99 75	99 99	99 70	100
93	99 82	99 78	99 81	99 90	99 85	99 89	99 76	99 87	99 74	99 74	99 99	99 69	98
96	99 80	99 76	99 79	99 87	99 83	99 87	99 74	99 85	99 72	99 72	99 99	99 68	96
94	99 78	99 74	99 78	99 84	99 81	99 85	99 72	99 84	99 70	99 71	99 99	99 66	94
92	99 75	99 72	99 76	99 81	99 79	99 83	99 70	99 82	99 68	99 69	99 95	97 65	92
90	99 73	99 70	99 74	99 78	99 77	99 81	99 68	99 80	98 67	99 67	99 93	94 64	90
88	99 69	98 66	99 72	99 76	99 74	99 79	97 66	99 79	97 65	99 66	99 90	92 62	88
86	99 67	95 64	99 68	99 70	99 73	99 72	99 77	99 76	93 63	98 64	99 88	89 61	86
84	99 65	92 62	99 66	99 69	99 70	99 75	90 62	99 76	87 61	94 63	99 85	85 60	84
80	95 62	89 60	95 64	94 64	97 66	99 73	84 59	99 73	72 57	88 60	99 81	72 57	80
73	89 60	86 58	92 62	81 58	88 61	98 67	60 53	99 70	59 54	81 56	99 76	62 54	76
76	80 58	84 56	89 60	81 58	88 61	98 67	60 53	99 70	59 54	81 56	99 76	62 54	76
74	69 56	81 54	86 58	72 55	82 59	97 65	50 51	99 68	52 52	73 55	99 73	56 53	74
72	61 54	69 53	83 57	57 52	74 57	91 63	41 49	99 66	49 50	67 53	99 71	52 51	72
70	52 52	60 51	72 55	42 50	66 55	88 61	36 47	99 65	36 48	59 52	98 69	47 50	70
68	47 49	54 49	63 53	32 47	58 52	86 59	28 45	99 63	33 46	51 50	97 66	43 49	68
66	35 47	41 47	45 51	24 44	50 50	82 57	22 43	99 62	27 44	44 49	91 64	39 47	66
64	28 45	32 45	33 49	19 41	44 48	67 55	17 40	99 60	23 42	36 47	87 61	35 46	64
62	22 43	24 43	27 47	16 38	35 46	56 53	15 38	92 59	20 41	29 45	80 59	32 45	62
60	18 41	18 41	26 45	13 35	31 44	47 51	10 36	79 57	17 39	17 44	74 57	27 43	60
58	14 39	16 39	25 43	8 32	22 41	44 49	7 34	66 56	13 37	15 42	67 54	21 42	58
56	9 36	15 37	23 41	4 29	15 39	38 46	5 32	57 54	10 35	12 41	62 52	19 40	56
54	8 34	13 35	22 39	2 26	12 37	25 44	3 30	54 52	7 33	10 39	53 49	16 39	54
52	7 32	11 33	19 38	0 24	8 35	20 42	2 28	50 51	6 31	9 38	42 47	9 38	52
50	4 30	10 31	16 36	0 21	4 33	17 40	2 26	43 49	3 29	7 36	33 45	8 36	50
48	3 28	9 29	11 34	0 18	3 30	16 38	2 23	37 48	1 27	6 34	26 42	8 35	48
46	2 26	8 27	8 32	0 15	3 28	13 36	1 21	32 46	0 26	5 33	15 40	7 34	46
44	2 23	8 25	7 30	0 12	2 26	10 34	0 19	28 45	0 24	5 31	10 38	7 32	44
42	1 21	8 23	5 28	0 9	0 24	7 32	0 17	25 43	0 22	4 30	6 35	6 31	42
40	0 19	7 22	4 26	0 6	0 22	5 30	0 15	22 42	0 20	4 28	4 33	4 30	40
38	0 17	7 20	4 24	0 3	0 19	4 28	0 13	19 40	0 18	4 27	3 30	4 28	38
36	0 15	7 18	4 22	0 0	0 17	1 26	0 11	18 38	0 16	4 25	2 28	3 27	36
34	0 13	6 16	3 20	0 0	0 15	0 24	0 9	17 37	0 14	4 23	1 26	3 25	34
32	0 10	6 14	3 19	0 0	0 13	0 22	0 7	15 35	0 13	3 22	0 23	2 24	32
30	0 8	6 12	3 17	0 0	0 10	0 20	0 4	14 34	0 11	3 20	0 21	2 23	30
28	0 6	5 10	3 15	0 0	0 8	0 18	0 2	13 32	0 9	3 19	0 18	2 21	28
26	0 4	5 8	3 13	0 0	0 6	0 16	0 0	12 31	0 7	3 17	0 16	2 20	26
24	0 2	4 6	2 11	0 0	0 4	0 14	0 0	10 29	0 5	3 16	0 14	2 19	24
22	0 0	4 4	2 9	0 0	0 2	0 12	0 0	9 28	0 3	2 14	0 11	1 17	22
20	0 0	4 2	2 7	0 0	0 0	0 10	0 0	8 26	0 1	2 13	0 9	1 16	20
18	0 0	3 0	2 5	0 0	0 0	0 8	0 0	7 24	0 0	2 11	0 6	1 14	18
16	0 0	3 0	2 3	0 0	0 0	0 6	0 0	6 21	0 0	2 9	0 4	1 13	16
14	0 0	3 0	1 1	0 0	0 0	0 4	0 0	5 20	0 0	1 8	0 2	0 12	14
12	0 0	2 0	1 0	0 0	0 0	0 2	0 0	4 18	0 0	1 6	0 0	0 10	12
10	0 0	2 0	0 0	0 0	0 0	0 0	0 0	3 17	0 0	1 5	0 0	0 9	10
8	0 0	1 0	0 0	0 0	0 0	0 0	0 0	2 15	0 0	0 3	0 0	0 8	8
6	0 0	1 0	0 0	0 0	0 0	0 0	0 0	2 14	0 0	0 2	0 0	0 6	6
4	0 0	0 0	0 0	0 0	0 0	0 0	0 0	2 14	0 0	0 0	0 0	0 5	4
2	0 0	0 0	0 0	0 0	0 0	0 0	0 0	0 12	0 0	0 0	0 0	0 4	2

NOTE: Place straight edge on percent columns on each side of Tables 2 & 3, identify test and read Standard Scores. Interpolation is required for scores falling between any given interval. These Standard Scores are based on approximately 2200 cases, tested between Spring 1974 and Spring 1976.

Table 2 (continued)

SUMMARY OF STANDARD SCORES FOR 24 NOCTI WRITTEN TESTS

PCT	IELAN		IERIC		MACHD		MACHT		MASON		MECHT		PLUMB		PRINT		QFOOD		SHEET		SENG		WELD		PCT
	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	
100	99	77	99	78	99	79	99	96	99	78	99	99	99	99	99	91	99	91	99	74	99	93	99	88	100
98	99	75	99	76	99	77	99	94	99	75	99	99	99	99	99	89	99	89	99	73	99	90	99	86	98
96	99	73	99	75	99	75	99	91	99	73	99	99	99	99	99	88	99	87	99	71	99	86	99	84	96
94	98	72	99	73	99	73	99	89	99	71	99	99	99	97	99	86	99	85	99	70	99	83	99	82	94
92	98	70	99	72	99	71	99	87	99	68	99	99	99	94	99	84	99	83	99	69	99	80	99	80	92
90	97	68	99	71	98	68	99	85	99	66	99	99	99	91	99	83	99	80	99	67	99	77	99	78	90
88	97	66	99	69	96	66	99	83	99	63	99	99	99	89	99	81	99	78	99	66	99	74	99	76	88
86	96	65	98	68	92	64	99	81	96	61	99	99	99	86	99	80	99	76	99	64	99	71	99	74	86
84	94	63	96	66	90	62	99	78	90	58	99	99	99	83	99	78	99	74	99	63	98	67	99	72	84
82	89	61	93	65	84	60	99	76	73	55	99	99	99	80	99	77	99	72	97	62	97	64	99	70	82
80	85	59	92	63	75	58	99	74	59	54	99	99	99	78	99	75	99	70	96	60	91	61	99	68	80
78	81	58	91	62	68	55	99	72	48	51	99	99	99	75	99	73	98	68	94	59	74	58	98	66	78
76	76	56	84	61	63	53	99	70	40	49	99	99	99	72	99	72	97	66	86	58	68	55	95	65	76
74	66	54	81	59	56	51	99	68	30	46	99	99	97	69	99	70	94	64	83	56	57	52	91	63	74
72	59	52	79	58	48	49	96	65	21	44	99	99	95	67	99	69	87	62	79	55	42	48	87	61	72
70	50	51	77	56	41	47	92	63	17	42	99	98	93	64	99	67	82	59	66	53	35	45	79	59	70
68	39	49	67	55	30	44	87	61	14	39	99	94	89	61	97	65	81	57	55	52	28	42	74	57	68
66	37	47	61	54	22	42	83	59	13	37	99	91	82	58	96	64	77	55	46	51	24	39	70	55	66
64	33	45	54	52	16	40	74	57	11	34	99	87	74	56	92	62	61	53	36	49	8	36	61	53	64
62	23	44	46	51	13	38	66	54	8	32	99	83	61	53	89	61	48	51	26	48	6	33	53	51	62
60	15	42	42	49	9	36	58	52	6	29	99	80	51	50	86	59	43	49	24	46	3	29	43	49	60
58	14	40	40	48	5	34	51	50	5	27	99	76	46	47	81	58	38	47	22	45	2	26	38	47	58
56	13	38	39	47	4	31	42	48	5	25	99	72	36	45	76	56	29	45	20	44	2	23	33	45	56
54	11	37	34	45	2	29	35	46	4	22	99	69	25	42	59	54	25	43	17	42	2	20	27	43	54
52	9	35	28	44	1	27	29	44	4	20	99	65	21	39	55	53	19	40	15	41	2	17	21	41	52
50	7	33	25	42	1	25	19	41	3	17	99	61	10	37	48	51	14	38	13	40	2	14	16	40	50
48	6	31	22	41	0	23	16	39	3	15	99	58	7	34	44	50	10	36	13	38	2	10	13	38	48
46	5	30	19	40	0	20	13	37	3	13	87	54	5	31	39	48	8	34	12	37	2	7	13	36	46
44	5	28	15	38	0	18	9	35	3	10	75	50	2	28	34	46	6	32	12	35	1	4	5	34	44
42	5	26	13	37	0	16	5	33	3	8	62	47	2	26	31	45	5	30	11	34	1	1	4	32	42
40	4	24	9	35	0	14	2	31	2	5	50	43	2	23	28	43	3	28	11	33	1	0	3	30	40
38	4	23	8	34	0	12	0	28	2	3	48	39	2	20	25	42	2	26	10	31	1	0	2	28	38
36	3	21	7	33	0	9	0	26	2	0	45	36	2	17	21	40	0	24	10	30	1	0	1	26	36
34	3	19	5	31	0	7	0	24	2	0	43	32	2	15	19	39	0	22	9	28	1	0	0	24	34
32	3	17	3	30	0	5	0	22	2	0	40	28	1	12	18	37	0	19	9	27	1	0	0	22	32
30	3	16	0	28	0	3	0	20	2	0	38	25	1	9	15	35	0	17	8	26	1	0	0	20	30
28	2	14	0	27	0	1	0	17	2	0	35	21	1	6	11	34	0	15	8	24	0	0	0	18	28
26	2	12	0	26	0	0	0	15	2	0	33	17	1	4	6	32	0	13	7	23	0	0	0	16	26
24	2	10	0	24	0	0	0	13	1	0	30	14	1	1	1	31	0	11	7	21	0	0	0	14	24
22	2	9	0	23	0	0	0	11	1	0	28	10	1	0	0	29	0	9	6	20	0	0	0	13	22
20	2	7	0	21	0	0	0	9	1	0	25	6	0	0	0	27	0	7	6	19	0	0	0	11	20
18	2	5	0	20	0	0	0	7	1	0	23	2	0	0	0	26	0	5	5	17	0	0	0	9	18
16	1	3	0	19	0	0	0	4	0	0	20	0	0	0	0	24	0	3	5	16	0	0	0	7	16
14	1	2	0	17	0	0	0	2	0	0	18	0	0	0	0	23	0	0	4	15	0	0	0	5	14
12	1	0	0	16	0	0	0	0	0	0	15	0	0	0	0	21	0	0	3	13	0	0	0	3	12
10	0	0	0	14	0	0	0	0	0	0	13	0	0	0	0	20	0	0	3	12	0	0	0	1	10
8	0	0	0	13	0	0	0	0	0	0	10	0	0	0	0	18	0	0	2	10	0	0	0	0	8
6	0	0	0	12	0	0	0	0	0	0	8	0	0	0	0	16	0	0	2	9	0	0	0	0	6
4	0	0	0	10	0	0	0	0	0	0	5	0	0	0	0	15	0	0	1	8	0	0	0	0	4
2	0	0	0	9	0	0	0	0	0	0	3	0	0	0	0	13	0	0	0	6	0	0	0	0	2

Table 3

SUMMARY OF STANDARD SCORES FOR 24 NOCTI PERFORMANCE TESTS

PCT	ACON		AIRFR		ARCHD		AUTOB		AMECH		CMAKE		CARP		CTECH		COSMO		DIENG		ESTAL		ELCOM		PCT
	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	
100	99	63	99	64	99	63	99	64	99	64	99	63	99	68	99	65	99	68	99	65	99	64	99	59	100
98	98	61	97	62	99	61	95	62	98	63	98	62	97	67	99	64	99	67	96	63	97	63	91	58	98
96	96	60	94	60	97	60	88	61	94	62	94	61	94	66	99	63	98	65	90	62	92	62	75	56	96
94	91	58	90	58	96	59	82	59	88	60	81	59	92	65	99	63	96	63	87	60	89	61	69	55	94
92	86	57	85	56	90	58	75	57	84	59	69	58	90	64	99	62	91	62	84	59	85	60	55	54	92
90	83	56	80	54	74	57	68	56	78	58	66	57	88	63	99	61	87	60	80	57	77	59	48	53	90
88	64	54	70	52	61	56	56	54	70	56	64	56	86	62	99	60	82	58	75	56	74	58	42	51	88
86	54	53	55	50	58	54	50	52	64	55	63	55	82	61	99	59	79	57	68	54	71	57	34	50	86
84	43	51	33	48	54	53	44	50	56	54	62	54	80	61	97	58	74	55	58	53	69	56	29	49	84
82	36	50	31	46	51	52	41	49	49	52	53	53	79	60	94	58	62	54	50	51	65	55	25	48	82
80	33	48	29	44	47	51	36	47	44	51	51	52	77	59	91	57	54	52	42	50	59	54	21	46	80
78	29	47	27	42	38	50	34	45	39	50	50	51	75	58	88	56	44	50	40	49	53	53	19	45	78
76	26	46	25	40	35	49	28	43	37	48	45	50	72	57	85	55	35	49	34	47	51	52	17	44	76
74	22	44	23	38	28	47	23	42	33	47	42	48	70	56	76	54	31	47	30	46	49	51	16	42	74
72	16	43	20	36	26	46	17	40	28	46	38	47	68	55	63	53	26	45	29	44	47	50	16	41	72
70	9	41	18	34	24	45	12	38	25	45	33	46	62	54	50	53	22	44	28	43	42	49	15	40	70
68	7	40	16	32	23	44	9	36	21	43	25	45	61	53	47	52	17	42	23	41	39	48	12	39	68
66	6	38	14	30	21	43	8	35	19	42	24	44	59	52	43	51	16	41	20	40	36	47	10	37	66
64	6	37	12	28	19	42	6	33	18	41	23	43	57	51	40	50	13	39	15	38	33	46	9	36	64
62	6	36	11	26	18	40	5	31	16	39	22	42	53	50	36	49	10	37	12	37	30	45	8	35	62
60	5	34	10	24	17	39	4	30	14	38	21	41	51	49	33	48	8	36	11	35	27	44	7	34	60
58	5	33	10	22	16	38	3	28	11	37	20	40	46	48	32	48	8	34	10	34	24	43	5	32	58
56	4	31	10	20	15	37	2	26	8	35	18	39	42	47	31	47	7	32	9	32	23	42	5	31	56
54	4	30	9	18	13	36	1	24	7	34	17	37	37	46	31	46	5	31	8	31	20	41	5	30	54
52	4	28	9	16	12	35	0	23	7	33	15	36	33	45	30	45	5	29	8	29	17	40	5	28	52
50	4	27	9	14	11	33	0	21	6	32	13	35	30	44	29	44	4	28	7	28	16	39	5	27	50
48	4	26	8	12	10	32	0	19	5	30	12	34	27	43	28	44	4	26	6	26	15	38	4	26	48
46	3	24	8	10	9	31	0	17	5	29	11	33	23	42	27	43	3	24	3	25	14	37	4	25	46
44	3	23	8	8	8	30	0	16	3	28	9	32	21	41	27	42	3	23	3	23	13	36	4	23	44
42	3	21	7	6	7	29	0	14	2	26	8	31	19	40	26	41	2	21	3	22	13	35	4	22	42
40	3	20	7	4	7	28	0	12	2	25	7	30	16	39	25	40	0	19	3	20	9	34	4	21	40
38	3	18	7	2	6	26	0	10	2	24	3	29	13	38	24	39	0	18	2	19	7	33	4	19	38
36	2	17	6	0	5	25	0	9	1	22	3	28	9	37	24	39	0	16	2	17	6	32	3	18	36
34	2	16	6	0	4	24	0	7	1	21	3	27	7	36	23	38	0	14	2	16	5	31	2	17	34
32	2	14	6	0	4	23	0	5	1	20	3	25	7	35	22	37	0	13	2	14	4	30	2	16	32
30	2	13	5	0	4	22	0	4	0	18	2	24	6	34	21	36	0	11	2	13	3	29	2	14	30
28	2	11	5	0	3	21	0	2	0	17	2	23	5	33	20	35	0	10	2	11	1	28	2	13	28
26	2	10	5	0	3	19	0	0	0	16	2	22	3	32	20	34	0	8	2	10	0	27	1	12	26
24	2	8	4	0	3	18	0	0	0	15	2	21	2	31	19	34	0	6	2	9	0	26	1	11	24
22	2	7	4	0	3	17	0	0	0	13	2	20	2	30	18	33	0	5	1	7	0	25	1	9	22
20	2	6	3	0	2	16	0	0	0	12	2	19	0	29	17	32	0	3	1	6	0	24	1	8	20
18	1	4	3	0	2	15	0	0	0	11	1	18	0	28	16	31	0	1	1	4	0	23	0	7	18
16	1	3	3	0	2	14	0	0	0	9	1	17	0	28	15	30	0	0	1	3	0	22	0	5	16
14	1	1	2	0	2	12	0	0	0	8	1	16	0	27	13	29	0	0	0	1	0	21	0	4	14
12	1	0	2	0	1	11	0	0	0	7	0	14	0	26	11	29	0	0	0	0	0	20	0	3	12
10	1	0	2	0	1	10	0	0	0	5	0	13	0	25	9	28	0	0	0	0	0	19	0	2	10
8	1	0	1	0	0	9	0	0	0	4	0	12	0	24	8	27	0	0	0	0	0	18	0	0	8
6	1	0	1	0	0	8	0	0	0	3	0	11	0	23	6	26	0	0	0	0	0	17	0	0	6
4	1	0	0	0	0	7	0	0	0	1	0	10	0	22	4	25	0	0	0	0	0	16	0	0	4
2	0	0	0	0	0	6	0	0	0	0	0	9	0	21	2	24	0	0	0	0	0	15	0	0	2

Table 3 (continued)

SUMMARY OF STANDARD SCORES FOR 24 NOCTI PERFORMANCE TESTS

PCT	IELAN		IERIC		MACHD		MACHT		MASON		MECHT		PLUMB		PRINT		QFOOD		SHEET		SENGR		WELD		PCT
	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	%L	T	
100	99	67	99	62	99	65	99	65	99	61	99	60	99	69	99	70	99	61	99	64	99	64	99	62	100
98	96	65	97	61	99	63	98	64	95	60	99	59	99	68	98	69	95	60	98	63	99	63	97	61	98
96	91	63	92	60	98	62	97	63	85	59	99	58	99	66	97	67	89	59	96	62	97	61	92	60	96
94	88	61	86	59	95	61	95	63	81	58	99	58	98	65	93	65	81	58	94	61	94	60	85	58	94
92	86	59	80	58	89	60	92	62	75	57	99	57	97	63	91	64	78	57	92	60	86	59	79	57	92
90	79	57	71	58	83	59	85	61	66	56	97	56	95	62	89	62	75	56	90	59	72	58	72	56	90
88	72	55	67	57	76	58	79	60	58	55	94	56	91	60	87	61	71	56	70	58	66	56	67	55	88
86	65	53	62	56	72	57	75	59	52	54	92	55	86	59	84	59	65	55	67	57	62	55	59	54	86
84	48	51	58	55	68	56	70	58	45	53	90	54	79	57	79	58	60	54	63	56	58	54	54	53	84
82	41	49	55	54	65	55	66	57	43	52	87	54	73	56	66	56	55	53	60	55	51	53	46	52	82
80	34	47	51	53	56	54	62	56	41	51	85	53	63	54	62	55	45	52	58	54	44	52	37	51	80
78	29	45	46	52	49	52	59	55	39	50	83	52	56	53	59	53	38	51	55	53	42	50	32	50	78
76	24	43	43	52	41	51	57	54	37	49	80	52	52	52	57	52	36	51	53	52	39	49	30	49	76
74	21	41	40	51	39	50	54	53	35	48	78	51	41	50	55	50	33	50	51	51	36	48	29	48	74
72	18	38	38	50	37	49	52	52	34	47	76	50	32	49	51	48	31	49	50	50	32	47	26	47	72
70	15	36	36	49	35	48	49	51	32	46	73	50	26	47	39	47	28	48	48	49	29	45	24	46	70
68	10	34	34	48	32	47	44	50	31	45	71	49	23	46	33	45	26	47	46	48	27	44	23	45	68
66	7	32	33	47	29	46	42	49	30	44	69	48	22	44	30	44	23	46	43	48	25	43	22	44	66
64	4	30	32	47	26	45	40	48	29	43	66	48	21	43	28	42	22	45	38	47	24	42	19	43	64
62	3	28	30	46	23	44	38	47	28	42	64	47	20	41	24	41	21	45	34	46	23	41	19	42	62
60	3	26	28	45	21	43	33	46	27	41	62	46	19	40	20	39	20	44	29	45	20	39	19	41	60
58	3	24	28	44	20	41	31	45	26	40	59	46	18	38	15	38	18	43	27	44	16	38	16	40	58
56	3	22	27	43	17	40	29	44	25	39	57	45	17	37	8	36	17	42	26	43	13	37	14	39	56
54	3	20	27	42	15	39	27	43	24	38	55	44	16	36	4	35	15	41	25	42	12	36	12	37	54
52	2	18	22	42	13	38	25	42	23	37	52	44	14	34	4	33	14	40	24	41	11	34	11	36	52
50	2	16	20	41	10	37	24	41	22	36	50	43	11	33	3	31	14	40	23	40	10	33	11	35	50
48	2	14	19	40	8	36	20	40	21	35	48	42	8	31	3	30	13	39	23	39	9	32	10	34	48
46	2	12	18	39	7	35	18	39	20	34	46	42	6	30	2	28	13	38	22	38	8	31	10	33	46
44	2	9	18	38	4	34	16	38	4	33	44	41	5	28	2	27	12	37	21	37	7	30	8	32	44
42	2	7	17	37	3	33	15	37	4	32	42	40	4	27	2	25	12	36	20	36	6	28	7	31	42
40	2	5	16	37	3	31	11	36	4	31	40	40	4	25	2	24	11	35	20	35	5	27	6	30	40
38	2	3	14	36	3	30	10	35	3	30	38	39	4	24	2	22	11	35	19	34	4	26	6	29	38
36	2	1	14	35	2	29	6	34	3	29	36	38	4	22	2	21	10	34	18	33	3	25	5	28	36
34	2	0	13	34	2	28	5	33	3	28	34	38	3	21	2	19	10	33	12	32	2	23	5	27	34
32	2	0	8	33	2	27	4	32	3	27	32	37	3	20	1	18	10	32	9	31	2	22	4	26	32
30	1	0	7	32	2	26	3	31	3	26	30	36	3	18	1	16	10	31	8	31	2	21	4	25	30
28	1	0	6	32	2	25	2	30	3	25	28	36	3	17	1	14	9	30	8	30	2	20	3	24	28
26	1	0	5	31	1	24	2	29	2	24	26	35	3	15	1	13	9	30	7	29	2	19	3	23	26
24	1	0	5	30	1	23	2	28	2	23	24	34	2	14	1	11	9	29	7	28	1	17	2	22	24
22	1	0	4	29	0	22	2	27	2	22	22	34	2	12	0	10	8	28	6	27	1	16	1	21	22
20	0	0	3	28	0	20	1	26	2	21	20	33	2	11	0	8	7	27	5	26	1	15	0	20	20
18	0	0	3	27	0	19	1	25	2	20	18	32	2	9	0	7	6	26	5	25	1	14	0	19	18
16	0	0	2	27	0	18	0	24	1	19	16	32	2	8	0	5	5	25	4	24	0	13	0	17	16
14	0	0	2	26	0	17	0	23	1	18	14	31	1	6	0	4	3	24	4	23	0	11	0	16	14
12	0	0	1	25	0	16	0	23	1	17	12	30	1	5	0	2	2	24	3	22	0	10	0	15	12
10	0	0	1	24	0	15	0	22	0	16	10	30	0	4	0	1	2	23	3	21	0	9	0	14	10
8	0	0	0	23	0	14	0	21	0	15	8	29	0	2	0	0	1	22	2	20	0	8	0	13	8
6	0	0	0	22	0	13	0	20	0	14	6	28	0	1	0	0	1	21	2	19	0	6	0	12	6
4	0	0	0	22	0	12	0	19	0	13	4	28	0	0	0	0	0	20	1	18	0	5	0	11	4
2	0	0	0	21	0	11	0	18	0	11	2	27	0	0	0	0	0	19	0	17	0	4	0	10	2

NATIONAL OCCUPATIONAL COMPETENCY TESTING INSTITUTE

Reliability and Standard Error Measurement of NOCTI Written Test Scores - Table 4

Examination	N	Med	Mean	Std Dev	KR20	SEKR20	KR21	SEKR21
Air Conditioning	49	100	100	17.5	.907	5.34	.875	6.19
Airframe & Power	13	113	117.7	21.2	.932	5.53	.902	6.64
Architectural Drafting	58	90	91	13.4	.861	4.99	.809	5.86
Auto Body Repair	57	101	98.3	14.9	.890	4.94	.855	5.67
Auto Mechanic	78	136	132	18.8	.913	5.55	.878	6.57
Cabinet Making	23	94	90.1	20.4	.931	5.36	.911	6.09
Carpentry	57	116	115.2	17.6	.925	4.82	.903	5.48
Civil Technology	26	62	63.4	13.3	.834	5.42	.796	6.01
Cosmetology	55	91	89.1	12.2	.888	4.08	.853	4.68
Diesel Engine	24	116	116.4	20.7	.944	4.90	.924	5.71
Electrical Install.	37	103	100.8	24.3	.947	5.59	.931	6.38
Electronics Comm.	67	92	87.9	20.7	.952	4.54	.941	5.03
Industrial Electrician	27	134	130.3	17.4	.902	5.45	.854	6.65
Industrial Electronics	32	99	95.3	22.6	.951	5.00	.938	5.63
Machine Drafting	66	105	102.7	12.9	.893	4.22	.850	4.99
Machine Trades	108	106	103.9	18.1	.914	5.31	.889	6.03
Masonry	11	78	76.6	6.6	.756	3.26	.594	4.21
Mechanical Tech.	6	28	29.2	4.9	.533	3.35	.348	3.96
Plumbing	10	100	102.5	14.4	.885	4.88	.813	6.23
Printing	47	79	76.8	11.5	.830	4.74	.769	5.53
Quantity Food Prep.	43	116	115.8	17.1	.874	6.07	.838	6.88
Sheet Metal	20	81	80.8	7.8	.739	3.98	.637	4.70
Small Engine Repair	18	124	116.8	27.7	.974	4.47	.962	5.40
Welding	69	97	98.8	14.5	.878	5.06	.836	5.87

KEY:

- N = Number in test sample
- Med = Median
- Std Dev = Standard Deviation
- KR20 = Estimated Reliability
- KR21 = Estimated Reliability
- SEKR20 = Standard Error of the Measurement
- SEKR21 = Standard Error of the Measurement

Table 5

CUMULATIVE NATIONAL NORMS - Spring 1974 thru Spring 1976

EXAMINATION	WRITTEN TEST							PERFORMANCE TEST						
	# of CAND	# of ITEMS	% CORRECT MIN	MAX	MEAN	STD. DEV.	MED- IAN	# of CAND	# of ITEMS	% CORRECT MIN	MAX	MEAN	STD. DEV.	MED- IAN
AIR CONDITIONING	106	165	38	84	68.5	9.2	61	84	200	4	100	82.3	14.0	52
AIRFRAME & POWER PLANT	11	183	49	87	69.4	10.3	68	9	530	63	99	85.7	9.9	81
ARCHITECTURAL DRAFTING	22	150	41	81	65.1	10.5	61	21	220	33	100	78.5	17.2	66
AUTO BODY REPAIR	114	150	53	84	70.3	6.9	68	111	215	44	100	83.6	11.5	72
AUTO MECHANIC	390	200	41	85	65.8	9.1	63	370	367	16	100	78.3	15.3	58
CABINET MAKING & MILLWORK	67	160	36	81	59.5	9.8	58	56	425	38	99	76.8	18.2	68
CARPENTRY	273	159	42	91	73.1	9.4	66	247	120	12	100	62.3	20.6	56
CIVIL TECHNOLOGY	10	152	22	64	50.9	12.9	43	6	401	17	85	63.7	24.2	51
COSMETOLOGY	109	120	45	92	72.2	10.7	68	112	122	34	99	77.6	12.3	66
DIESEL ENGINE REPAIR	34	167	19	89	67.8	12.8	54	32	200	47	100	80.0	13.5	73
ELECTRICAL INSTALLATION	115	177	32	76	54.4	8.4	54	113	465	17	100	71.7	19.8	50
ELECTRONICS COMMUNICATION	74	130	32	95	70.0	14.6	63	70	675	19	100	85.8	15.7	59
INDUSTRIAL ELECTRICIAN	30	200	35	87	69.2	11.4	61	29	150	63	100	83.1	9.7	81
INDUSTRIAL ELECTRONICS	83	150	31	87	60.8	14.2	59	81	440	10	100	72.0	23.9	55
MACHINE DRAFTING	144	135	49	93	73.1	9.2	71	129	130	2	97	73.6	18.1	49
MACHINE TRADES	206	160	29	87	57.9	9.2	58	187	165	15	99	68.4	20.5	57
MASONRY	32	100	50	87	77.0	8.3	68	24	125	44	100	77.7	19.7	72
MECHANICAL TECHNOLOGY	2	65	40	48	43.8	5.4	44	2	225	50	92	70.9	29.9	71
PLUMBING	47	167	44	75	59.8	7.3	59	46	125	41	93	73.8	13.7	67
PRINTING	52	131	24	70	48.5	12.6	47	45	185	45	100	74.0	12.9	72
QUANTITY FOOD PREPARATION	54	197	37	79	61.1	9.5	58	50	590	6	100	74.7	23.8	53
SHEET METAL	15	112	21	84	65.1	14.4	52	11	160	33	92	71.2	21.2	62
SMALL ENGINE REPAIR	35	165	59	86	73.0	6.3	72	36	270	33	98	77.4	16.4	65
WELDING	115	155	34	83	60.9	10.4	58	115	307	11	100	77.8	19.0	55

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BIBLIOGRAPHY

- Anastasi, Anne, Psychological Testing, 4th Edition
MacMillian Publishing Company, New York, 1976.
- Davis, Frederick B, et al, Standards for Educational and Psychological Tests,
American Psychological Association, Washington, D. C., 1974.
- Ferguson, George A., Statistical Analysis in Psychology and Education,
McGraw Hill, New York, 1959.
- Kraft, C. H., and Eeden, C. V., A Nonparametric Introduction to Statistics,
MacMillian Publishing Company, New York, 1968.
- McNemar, Quinn, Psychological Statistics, 3rd Edition,
John Wiley, New York, 1962.
- Natrella, Mary G., Experimental Statistics, Handbook 91,
United States Department of Commerce, Washington, D. C., 1963.